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## THE PROPER SIZE OF METERS.

There may be found in another column an abstract of an interesting paper on the electric meter recently read by one of the authorities on this subject, Mr. Caryl D. Haskins. The writer brings out many interesting points and valuable suggestions, one of the latter being his advice as to the sizes of meters for variable loads. He advises the use wherever possible of smaller capacity meters than those now customary, especially for highly fluctuating loads, risking an occasional burnout for the added income obtainable from a better average percentage load on the meter. The importance of overload accuracy is also emphasized, even to the neglect of the light-load accuracy, for the reason that one hour's overload is worth much more than one hour of light load, and should be measured with corresponding accuracy. This may be the case where the average time of overload is equal to that on light load, but in ordinary, and especially in residence, service the meter is on a very light load 90 per cent., or perhaps 99 per cent., of the time, and on overload very rarely. The relative number of ampere hours at light and at heavy loads is the true measure of the relative accuracy required.

What is really wanted is accuracy over a considerable range, and what is needed in residence lighting—which is perhaps the most difficult load to measure—is an enormous overload capacity without burnouts. The average residence, which is wired, to cite a concrete example, for thirty lights, may have a daily load peak of six or eight lights, and an average load for the twenty-four hours of one or two lights, the average load on a 30-light meter being thus from 3 to 6 per cent. of its rated capacity, which is liable to introduce a great error in favor of the consumer at the expense of the central station. If, however, meters were capable of standing a continuous overload several times their rated capacity without endangering their structure and without introducing too great a voltage drop in the line, such an installation could be fed, for example, through a 10-light meter, which change would give a triple increase of the average percentage load, and in consequence a great increase of the accuracy of its measurement. Unfortunately, the electrical meter, to prevent too great an accumulation of dust in and about the jewel or the clockwork, must be carefully protected against ventilation, and this reduces most seriously the current-carrying capacity of the series coils. If some means could be found of increasing their radiating surface or of ventilating them without introducing air currents into the parts of the meter where dust is not wanted, it would be a great advance in the art of meter construction.

## THE WORK OF THE ELECTRIC VEHICLE COMPANY.

There appears on another page of this paper a description of the elaborate work undertaken by the Electric Vehicle Company in its development of electrically propelled vehicles in New York City The work deserves the highest commendation, owing to the enormous expense it necessitates and the rather uncertain character of the returns. Unlike a large amount of experimental work it does not in general establish a broad monopoly by patent rights over the results obtained. A large part of the work, such, for example, as the design of the elaborate apparatus necessary for rapidly handling the heavy battery trays, consists of details on which no

broad fundamental patents can be obtained, but nevertheless its cost is very great. The work is thus as much to the value of the public and future competitors as to the company itself, the only advantage which the latter can expect being the reputation which it can acquire, through careful engineering and upright business dealing, of being the pioneer and most reliable establishment in its chosen field. This field is, however, a broad one and such a reputation a few years hence will be an asset of no mean value.

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The first impression invariably given a superficial observer is one of wonder at the intricacy of the apparatus required for the apparently simple process of moving a battery from a vehicle to the charging table and vice versa. The difficult requirements which must be met, however, are obvious on a little thought. It is not a question unfortunately of manipulating one battery or a dozen batteries, but several hundred must be provided for, each weighing so much that rapid manipulation by hand is out of the question; therefore the number of charging tables must be very great, and some means must be provided for distributing the batteries from the vehicle position or positions to these many tables and vice versa. This requires means for independent movement in the directions of the three rectangular axes. The most simple, reliable and commonly used method of accomplishing this effect is the use of a crane, the bridge of which is capable of moving longitudinally along the ways, the trolley laterally along the bridge and the grab vertically from the trolley. In this particular installation the use of the trolley has been abandoned and a number of fixed grabs or hooks substituted in order to give the crane bridge the capacity for carrying more than one battery on each trip. To obtain lateral movement a separate endless chain conveying table is used, the batteries being deposited thereon or picked up therefrom by the crane hooks. The vehicle itself is one of the most serious difficulties for the reason that it is an unwieldy thing to get accurately in one position, and its springs and ability to roll make it such an annoyingly yielding receptacle for the insertion or withdrawal horizontally of a heavy clumsy load. It must be accurately centred and held from moving sideways. Its body must also be rigidly fastened so that it cannot move endways or up and down, and these various gripping and adjusting devices must be handled rapidly with a minimum of attendance. The problem is an intricate one, with no similar precedents, and the behavior of the installation will be watched with great curiosity by those interested in electrical vehicles the world over.

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#### THE TELEPHONE IN ENGLAND.

There has lately been presented to the House of Commons the report of a committee appointed to investigate the telephone industry in England and make suggestions as to its best treatment by the Government in the future. As is well known, the telegraph service of Great Britain is in the hands of the Government, being a department of the Post Office, and some years ago the telephone service, which was adjudged to be a department of the telegraph service, was first let out to various licensees, but afterward the exchange service was put under the control of one private company, known as the National Telephone Company, the agreement with which will expire in 1911. The trunk lines are owned and operated by the Post Office.

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Some parts of the committee's report suggest interesting developments, which may be profitably considered in other countries. One of these concerns the practical limitation of the service to subscribers. The defects of the flat rate system of charging for telephone service are shown by a comparison with the telegraph business, in which, if a similar policy were adopted, the use of the wires would practically be restricted to those able to bear the expense of a private line, and such subscribers could only communicate with individuals similarly situated. The message rate system so widely used in this country overcomes to a certain extent the first difficulty, since the charges are largely proportional to the amount of the service rendered, but the British committee upholds a plan whereby messages can also be sent to non-subscribers, which plan is in use in Switzerland, where for all messages actually sent subscribers and the public alike pay the same fixed toll, and messages can be delivered to non-subscribers by express messengers. In this way each instrument, but for the limitations imposed by the subscriber, becomes practically a toll telephone, and messages can be sent not only to subscribers but to any one accessible to a messenger.

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The municipalization of public services has come into considerable prominence in this country of late, but the telephone systems have never been invaded in this manner. The committee referred to above proposes that the local authorities or municipalities shall establish telephone systems in their respective districts in competition with the system of the National Telephone Company, and in conformity with various requirements which will make these systems uniform, so that they may be readily consolidated when the Post Office sees fit to take active control of the system the country over. As the committee points out, the telephone business is as much or more of a natural monopoly than is the telegraph business, and the working of two independent systems in one locality is not only a hardship on the competing companies but on the public as well, so that the committee's suggestions as to a means of breaking down the power of the present monopoly in England in order to establish another which shall be managed for the public good is certainly inconsistent with the public's welfare in the meantime.

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#### THE GENERAL ELECTRIC COMPANY'S PERMANENT EXHIBIT.

There may be found on other pages of this paper a description of the magnificent water power development and electric transmission plant of the Hudson River Power Transmission Company, near Mechanicville, N. Y. A large part of the power from this work will be used by the General Electric Company at Schenectady. The latter company has also recently acquired the local street railway and lighting plants in Schenectady, and will naturally proceed to modernize these and interlink them electrically with its factory power sources, and hence with the transmission system from Mechanicville. When this system is completed it will be a conspicuous example of the flexibility of the electric transmission and distribution of power now obtainable with the aid of stationary and rotary transformers. High-tension multiphase currents will enter the works, and there be transformed by means of motor-generators to direct current at 500 volts, and by means of rotary converters to direct current at 250 volts. Frequency changers will allow the supply of the existing public lighting circuits at the proper periodicity, series arc machines may be driven by alternating-current motors and the street railway system can be supplied by any one of several different methods. Existing power equipments can be kept in reserve to feed into the system at any one point, and by means of the reversibility of the various interlinking machines they can supply power to any other part. The use of a generous storage battery on any of the direct-current derivations will render the whole system safe against a brief shutdown of the source of power. The system in general, in connection with the magnificent works of the company, will make a most convincing exhibit to intending purchasers of the ability of the company in its various lines of work.

## Programme of the Coming Convention of the American Street Railway Association.

The following is the programme of the seventeenth annual meeting of the American Street Railway Association, to be held in Boston, Mass., September 6 to 9, 1898:

TUESDAY.

10 A. M.—Meeting called to order by Albion E. Lang, president. Calling of the roll. Invitation extended to join the Association. Address of the president. Report of the Executive Committee. Report of the secretary and treasurer. Reading of paper on "Comparative Earnings and Economy of Operation Between Single and Double Truck Cars for City Use," by Richard McCulloch, electrical engineer, Cass Avenue and Citizens' Street Railway Companies, St. Louis, Mo. Reading of paper on "Municipal Ownership of Street Railways." In the afternoon there will be a trip to Concord and Lexington and in the evening a reception at the hall.

WEDNESDAY.

Convene at 9:30 A. M. Reading of paper on "Maintenance and Equipment of Electric Cars for Street Railways," by M. S. Hopkins, electrician, Columbus Street Railway Company, Columbus, Ohio. Reading of paper on "Carrying of United States Mail Matter on Street Railways," by W. S. Dimmock, general superintendent, Omaha & Council Bluffs Railway and Bridge Company, Council Bluffs, Ia. Appointment of committee on nomination of officers and selection of next place of meeting. In the afternoon there will be an excursion down the harbor and a clambake at Nantasket Beach.

THURSDAY.

Convene at 9:30 A. M. Reading of paper on "To What Extent Should Street Railway Companies Engage in the Amusement Business," by Walton H. Holmes, general manager, Metropolitan Street Railway Company, Kansas City, Mo. Reading of paper on "Inspection and Testing of Motors and Car Equipments by Street Railway Companies," by Frederick D. Perkins, electrical engineer, Toledo Traction Company, Toledo, Ohio. Election of officers. In the afternoon there will be a trip to Plymouth and the annual dinner will be held at the Hotel Brunswick at 7 P. M.

FRIDAY.

Convene at 9:30 A. M. Reading of paper on "Cost of Electric Power for Street Railways at Switchboard, Both Steam and Water," by R. W. Conant, electrical engineer, Boston Elevated Railroad Company, Boston, Mass. Report of committee on standing rules for government of conductors and motormen. Unfinished business. Installation of officers. Adjournment. In the afternoon a trolley excursion to Norumbega Park will be arranged for those who desire to attend.

## The New Station of the Electric Vehicle Company.

The construction of the most elaborately equipped charging station for electric vehicles in the United States, and probably in the world, has just been completed in New York city. This work has been done by the Electric Vehicle Company, the successor of the Electric Carriage & Wagon Company, whose vehicles and station were described in THE ELECTRICAL WORLD of August 14 and 21, 1897. In these articles the vehicles themselves were fully described, so that but a brief mention of the essential points and the improvements over the older types is necessary here.

THE VEHICLES.

The original equipment of the old company was twelve hansom cabs and one brougham, while the new company is about to put into service fifty hansoms and the same number of broughams. The cabs are, as shown in the accompanying illustrations, Fig. 1, four-wheelers, driven by motors geared to the forward wheels and supplied with current from the battery box, situated under the driver's seat back of the passengers' compartment. Their running gear is practically the same as that shown in the elevations of the brougham, Fig. 2. Of the external and visible improvements over the old type one is an increase in the height of the hood, the older vehicles being so low as to have an unprepossessingly squatty appearance compared with horse-drawn cabs. A dashboard has been added to the front of the vehicle to improve its appearance

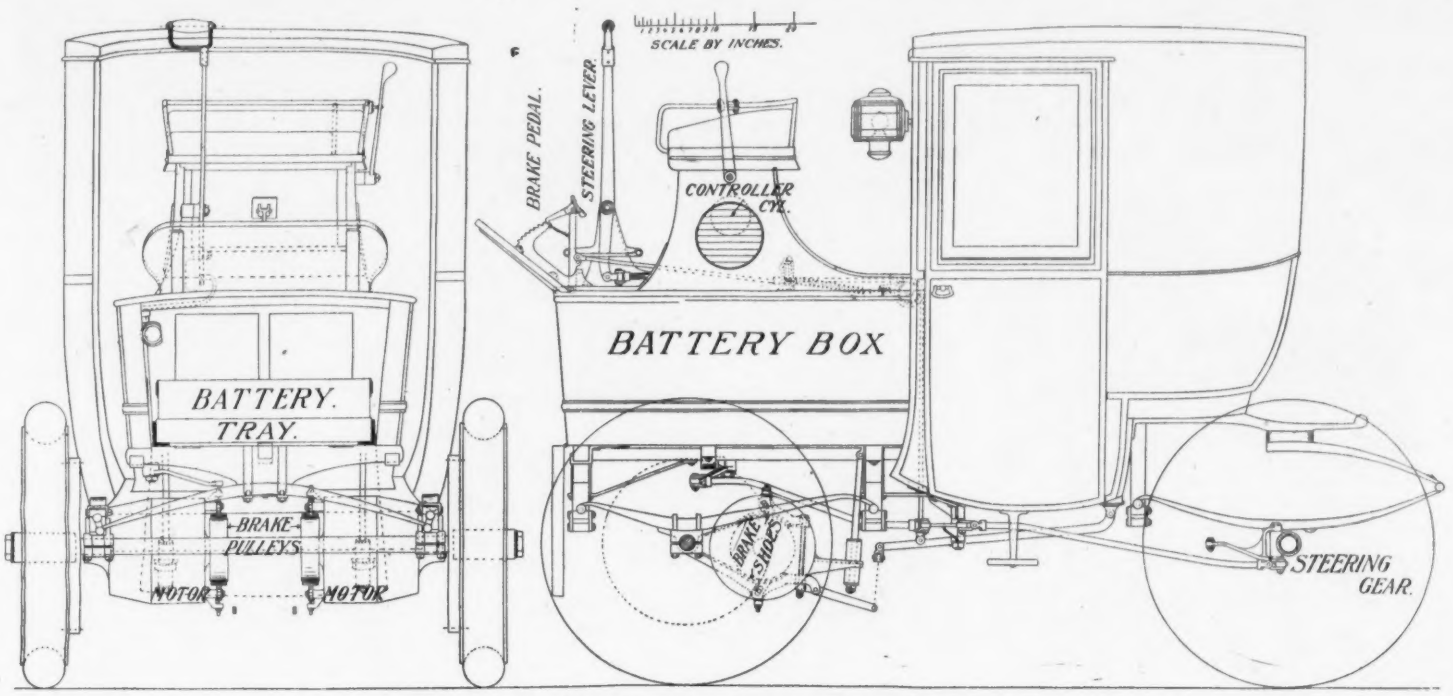



FIG. 2.—SIDE AND END ELEVATIONS OF ELECTRIC BROUGHAM.

and to give the occupant a sense of security that was lacking with the open fronts of the former vehicle. Another change is the use of solid discs instead of spokes for the wheels. At first sight a return to first principles of the wheels of ancient Egypt is the impression given, but in reality quite an improvement is made in that the wheel has a much less intricate surface, and is, therefore, more readily cleaned. The body of the wheel is composed of two steel discs one-sixteenth of an inch in thickness, dished so as to give a maximum breadth at the hub, and a minimum at the periphery. The discs do not meet at the latter point, but are separated by a wooden rim over which is a crescent-shaped steel rim to receive the tire, which is 5-inch single-tube pneumatic, the rubber walls of which are about three-quarters of an inch in thickness. All four of the wheels are 36 inches in diameter.

The batteries consist of forty-eight cells of Chloride accumulators of the F. V. type. The plates are separated by perforated corrugated hard rubber sheets, the battery jars being of hard rubber separated from each other by glass plates. Instead of mounting the cells, as was done in the older vehicles, in four separate trays which could be removed independently, thus dividing the weight so that they could be removed by hand, the batteries in the new vehicles are mounted in one substantial tray, consisting of an angle iron frame lined with wood. This change is allowable on

account of the power equipment described below for removing and replacing the batteries in the vehicles. The trays, instead of resting on rollers within the vehicles, slide in on angle iron guides, the battery chamber being entirely lined with lead and drained with gutters and spouts, so that any acid which may spill will not run out around the door or over the running gear and destroy the finish on the exterior of the vehicle. The battery equipment is somewhat heavier than on the old vehicles, weighing as it does about 1300 pounds.

The new controller, instead of being fitted with a reverse position, as was the former controller, is fitted with a separate but interlocking reversing switch, so that the three speed positions apply to either forward or backward running. No magnetic blowout is used with this controller, and each contact is made doubly certain by the use of two independent contact fingers in each division. See Fig. 3. The speed variation is obtained by means of a division of the battery into two groups, which may be placed in series or multiple, the third or highest speed being obtained by a rearrangement of the series field coils of the two motors from a series to a multiple combination. See Fig. 4.

In the main circuit there is also what is called an emergency switch, in such a position that the driver can strike it with his heel and open the main circuit in case for any reason the controller becomes inoperative. The blade of the emergency switch is also removable, and can be taken out when the driver leaves the vehicle, rendering it impossible for any unauthorized person to set the carriage in motion. A special charging plug is also attached to the circuits and mounted in the battery chamber for charging the battery in place in the vehicle. This will prove useful when the battery is charged at points other than the main station described below, and several such points will be equipped with charging connections by the various direct-current supply companies in and about the Greater New York. One is already in service at Coney Island, and another is about to be put in service in the downtown part of New York city at the Duane Street station of the Edison Electric Illuminating Company.

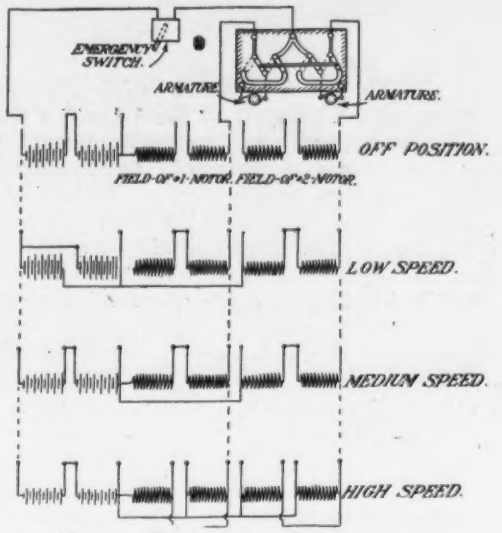



Fig 4.—Controller Combination.

The motors are four-polar, and are rated at 2 horse-power at about 700 r. p. m., this giving the vehicle a speed of 12 miles per hour. The pinion on the motor shaft engages directly with an annular gear mounted on the wheel disc, the two independent motors allowing for turning sharp corners without differential arrangements or serious strain. Braking is effected by means of brake shoes acting on wheels on the motor shafts. The steering gear is practically the same as on the older vehicles, the only difference being the removal of the pivots from within the wheel hubs to a point just outside, the pivots being inclined somewhat so that the extension of their axes approaches the point of contact of the wheel and ground.

### THE CHARGING STATION.

The new station is centrally located, and is, oddly enough, in the immediate neighborhood of the establishments of the largest houses interested in horses and horse-drawn vehicles, such as the American Horse Exchange, Tattersalls, Ltd., etc. The station which is about 75 x 200 feet in size, fronts on Broadway at one end and Seventh Avenue at the other, and is located between Fifty-second and Fifty-third Streets. The building consisted, before the vehicle company made use of it, of a single large room undivided by floors or partition walls, covered with a trussed roof. The Broadway end is now occupied by a tier of offices, waiting rooms, stock rooms and a gallery, and adjacent to the north wall of the station is the battery charging room, some 36 x 130 feet in size. This room is 11 feet in height, above it being a carriage storage room supported on 25-inch steel girders. The latter is reached by two electric vehicle elevators. The charging room is filled with tables on which the batteries stand while receiving their charge.

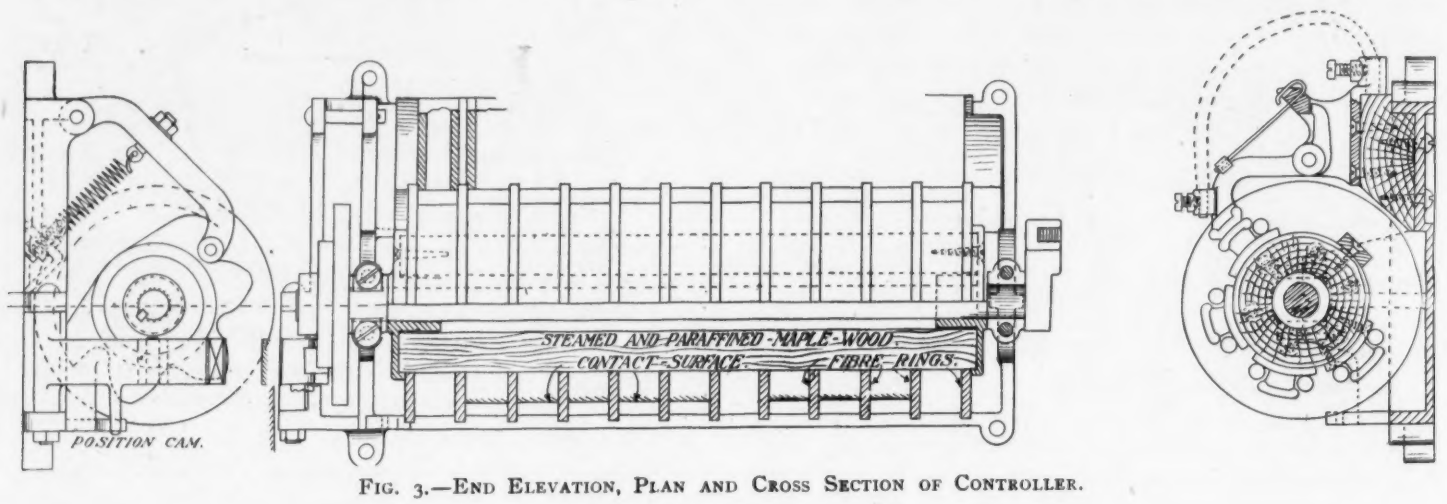



Fig. 3.—End Elevation, Plan and Cross Section of Controller.

There is room for some 200 of these tables, about 150 being installed at present in eight regular rows lengthwise of the room. The tables, as shown in Fig. 5, consist simply of strongly braced wooden structures put together with wooden dowel pins, no iron whatever being used in their construction, and painted black with P. & B. compound. Iron dowel pins projecting upwardly from the cement floor into holes in the table legs keep them in place, although they are not bolted down in any way, and may, therefore, when rotted by the acid fumes, be readily picked up and removed by the crane serving the room. Mounted upon them are four simple U-shaped pivoted castings, the weight of the battery coming down on the short leg of the U, causing the contact attached to the longer leg to bear against the contact terminal of the battery tray. One pair of diagonal contacts is cross-connected, so that the two groups of cells (forty-eight in number) are connected up in series for charging. The battery charging room is inclosed except at its ends and is ventilated by a 48-inch exhaust fan drawing air from the middle of the room.

The tables are supplied with current through twelve conductor lead-covered cables below the floor level, from what are known as the indicator boards. These, as shown in Fig. 6, are slate panels, each fitted with two pilot lamps, eight simple solenoidal ammeters and

eight four-position rotary switches. Each battery table is supplied with current through one of these switches and ammeters, the latter consisting simply of a vertical plunger, supported on a helical spring and surrounded by a solenoid, which tends to draw it down. Attached to the plunger is a carbon disc which strikes one

FIG. 5.—THE CHARGING TABLES.

contact rings attached to each rotary switch, the contact bearing thereon cutting off the lamps from the contacts of the corresponding indicator when the switch is on open circuit; thus the lamps indicate only for tables in actual service, and if more than one table is in service on one indicator board the attendant can readily tell which one is affecting the lamps by a glance at the ammeters. One-half of the indicator boards is supplied with current from the positive side of the three-wire 240-volt system; the other half from the negative side, and the demand for current is equalized between the two sides by the simple process of running in no neutral. On this account the aggregate current taken on the positive side must, of course, equal that on the negative side, and on whichever side there are fewer batteries the rate of charging will be more rapid. When, however, the station is fully loaded it will be a simple matter to equalize the number of charging tables in use on the two sides of the system.

The current reaches the indicator panels from the main board by eight bus bars (four positive and four negative) of rectangular cross section, varying from ¼ x 1 inch to ⅜ x 1¼ inches. This board, which is shown in Fig. 7, is a handsome structure of Vermont marble divided into nine panels and inclosed in a glass case to keep out acid fumes. One of the panels controls the various

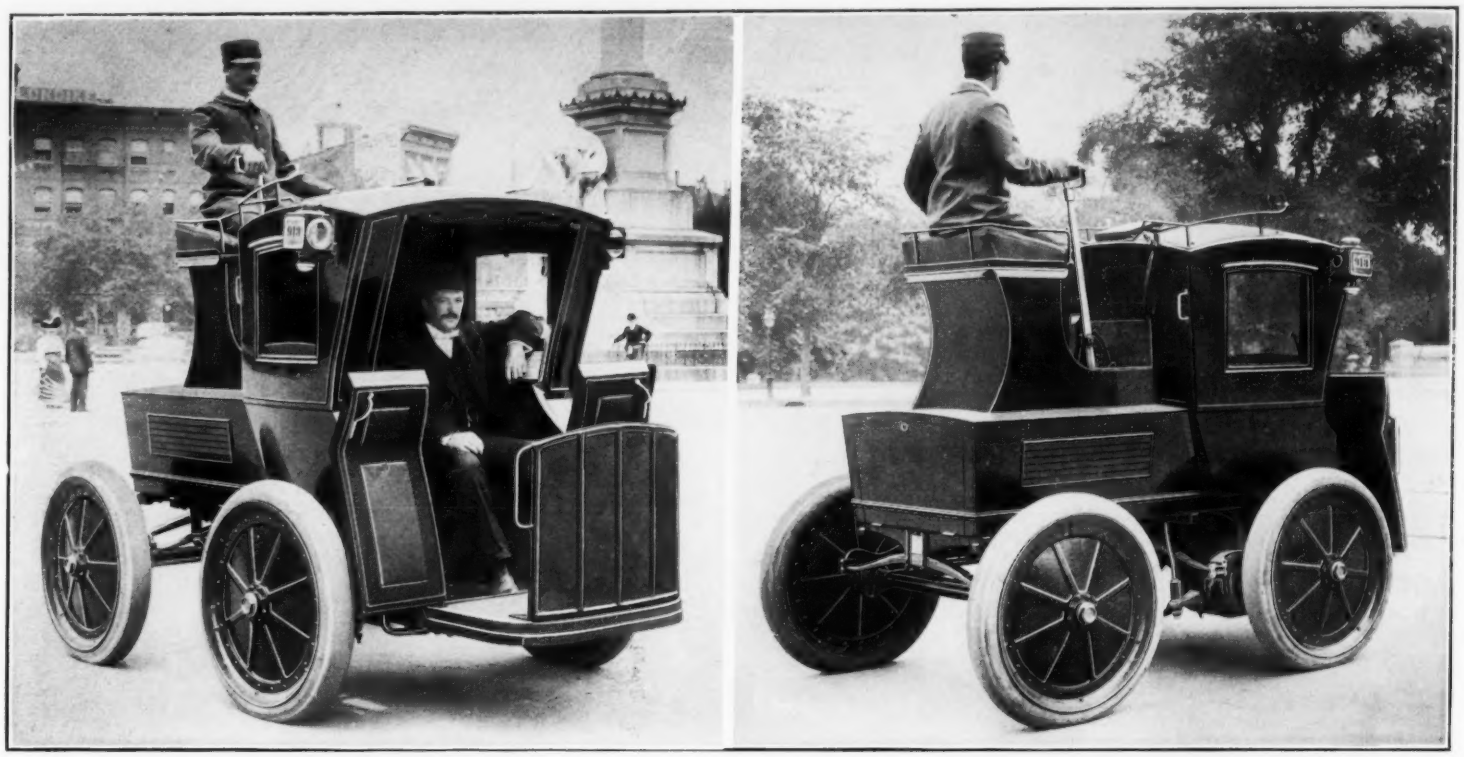


FIG. 1.—TWO VIEWS OF THE HANSOM.

contact when the current reaches 50 amperes, this contact closing the circuit through the green pilot lamp. If the current falls below 10 amperes the disc rises to a point at which it strikes a contact, illuminating the red pilot lamp. In this way the lamps give positive visual indications, which can be seen from any part of the charging room, that one of the batteries attached to that panel is receiving either an excessive charging current or one which should, to economize time, be increased. The current supplied to the batteries is adjusted by the four-position rotary switch, the four different positions connecting the battery terminal respectively to four bus bars with voltages differing from each other by about 5 volts. When a battery is first brought in for charging it is connected to the bus bar giving the lowest voltage, and when on this bus the charging current becomes less than 10 amperes the red lamp is illuminated. The attendant then turns the switch to throw the battery onto the next higher bus, and so on until, when the red lamp shines on the highest voltage, the charging process is complete and the battery may be removed. Since one pair of pilot lamps serves for the eight tables connected to the one panel of the indicator board, some means must be provided for preventing any indicating solenoid from illuminating the red lamp when there is no battery on the corresponding table, and consequently no current in the solenoid. This is accomplished by means of a pair of

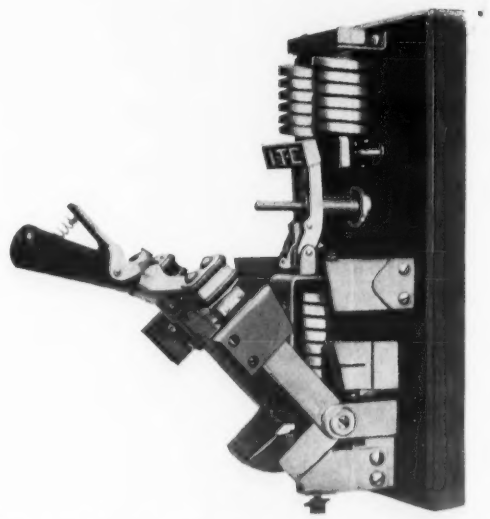


FIG. 8.—ONE OF THE OVERLOAD AND UNDERLOAD CIRCUIT BREAKERS.

light and motor circuits of the station, the other eight supplying the eight bus bars referred to above. The voltage differentiation is obtained by means of two boosters coupled to one motor, which give the highest voltage on the positive and negative sides respectively, the next highest being that of the supply mains themselves. The two lower voltages are obtained by passing the current through large enamel rheostats, the resistance of which can be varied by hand. The panels each contain an illuminated dial Weston voltmeter and ammeter and a Bristol recording voltmeter and ammeter. A voltmeter switch on each panel allows the corresponding indicating instrument to be connected to measure up the voltage on the incoming supply bus or the bus attached to that panel. Below the measuring instruments are a single-pole switch and a circuit breaker. The latter (see Fig. 8) is fitted for an underload release as well as the customary overload. The underload release is effected by a magnet energizd by a winding above the other parts of the breaker, the armature of which is attached to a pin which, shortly after the armature is released, strikes the trigger in such a way that it is tripped just as though struck by the regulation overload device. Current is supplied from the underground mains of the Edison Electric Illuminating Company over two independent services, the incoming cables having a cross section of 1,250,000 cm. The Edison Company has a station only about 600 feet away, so that the drop is but slight.

### HANDLING THE BATTERIES.

The design and construction of the machinery for removing the batteries from the carriages and placing them upon the charging tables and vice versa was no easy task. The trays, with their accumulators, weighing about 1300 pounds, must be pulled from a position on a spring-supported wheeled vehicle and transported to any one of 200 positions in the charging room, and vice versa. As may be seen, this manipulation is more difficult than the removal of battery trays hung under a street car truck, as in the latest designs of battery traction equipments, since the tray must be moved out horizontally to and from its place instead of vertically. The manipulation resembles more than anything else the handling of steel billets in the reheating furnaces of rolling mills, but the apparatus must be more elaborate than in the latter case, owing to the necessity of working with a movable wheeled vehicle, the body of which is mounted on springs.

To make the operation clear, the course of the battery from the time it arrives in an exhausted condition in its vehicle will be described. The vehicle is first moved onto a platform, of which two are provided in front of the end of the battery charging room (see Figs. 9 and 10), with its battery end toward the latter. If the vehicle is a hansom it is backed in; if a brougham it runs in a forward direction, the door through which the battery is removed being open in either case. The platform on which the vehicle runs is divided into two parts, on one of which rest the forward wheels and on the other the rear wheels, these two parts being laterally and independently movable. Once on this platform, a long horizontal shoe, shown best in Fig. 11, is advanced toward each side of the vehicle by two hydraulic cylinders, the shoe being of a proper height to push against the wheel hubs, centring the vehicle, which moves without slipping of the wheels, owing to the movable nature of the platforms below it, into the proper position. The vehicle is then backed in until heavy iron straps on its advancing end catch in latches projecting from the table, toward which it advances. When in the proper position two hydraulic cylinders (see Fig. 11) below the sliding platforms lift their cross-heads through the floor—in which are provided hinged slats to allow this motion—and pick up the body of the vehicle, raising it off from its spring to a fixed height independent of the load. This is necessary, since, if it were not done, the removal of the heavy battery would allow the vehicle to jump up, making the level of the battery compartment dependent on the condition of the springs, etc.

The body being raised to the proper height, there advances

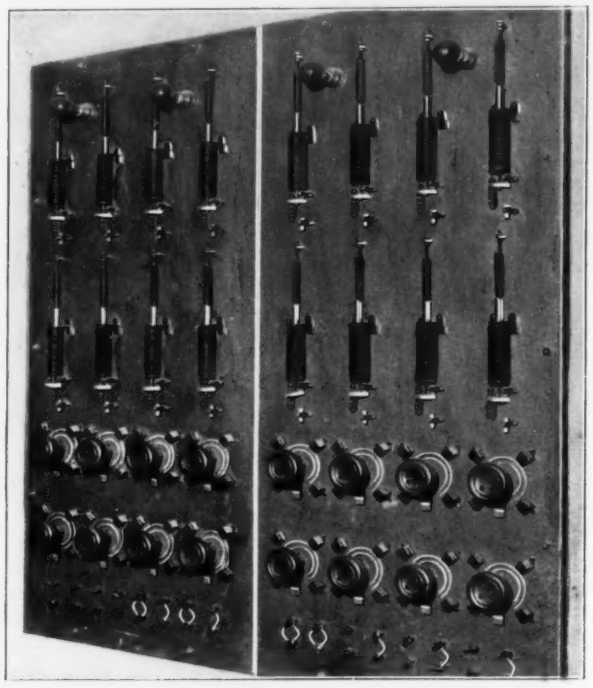


Fig. 6.—Two Panels of the Indicator Board.

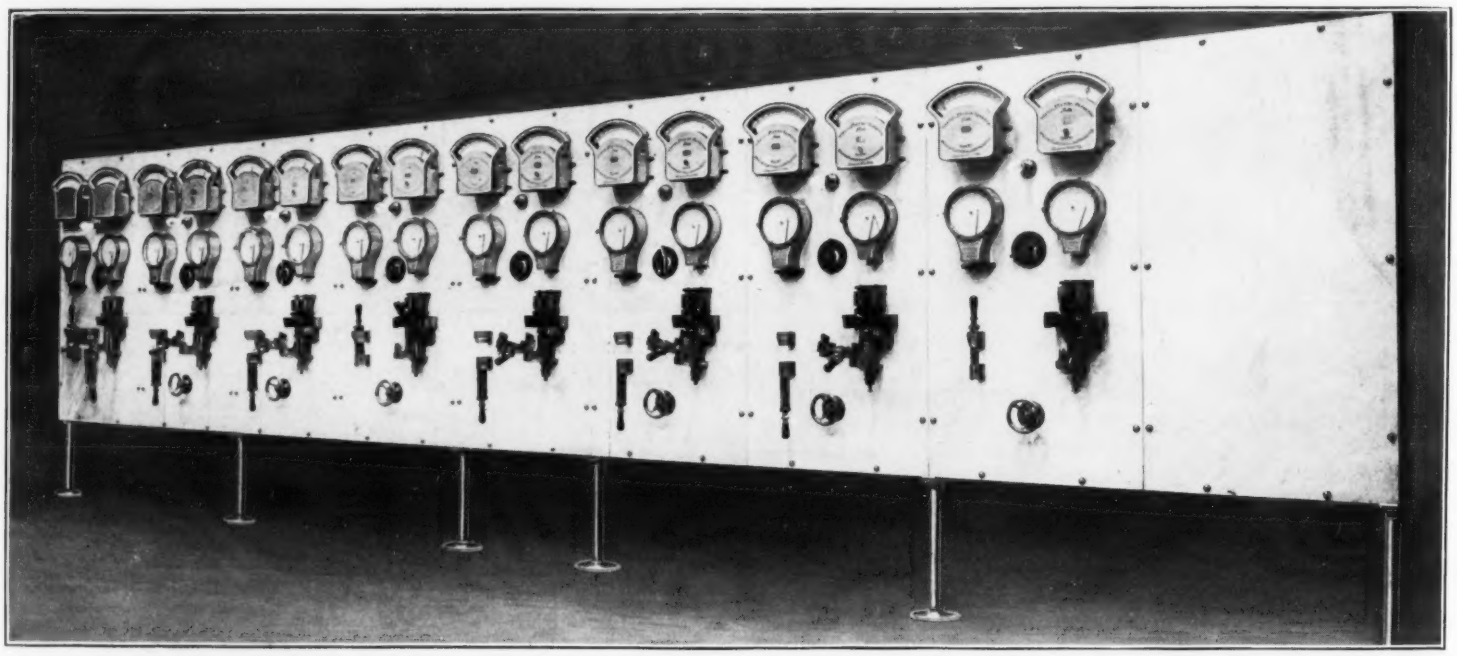


Fig. 7.—The Main Switchboard.

toward the open door of the battery chamber a hook attached to the piston of the horizontal hydraulic cylinder shown in Fig. 12. This latches into the frame of the battery tray and on the application of pressure pulls the latter out onto what is known as the conveyor table. The latter consists of a runway across the whole front of the battery charging room, equipped with a chain conveyor with frames attached thereto on which the battery trays may be carried to any desired position along the table.

Above the table is an 8-ton crane (see Figs. 9 and 10), its bridge

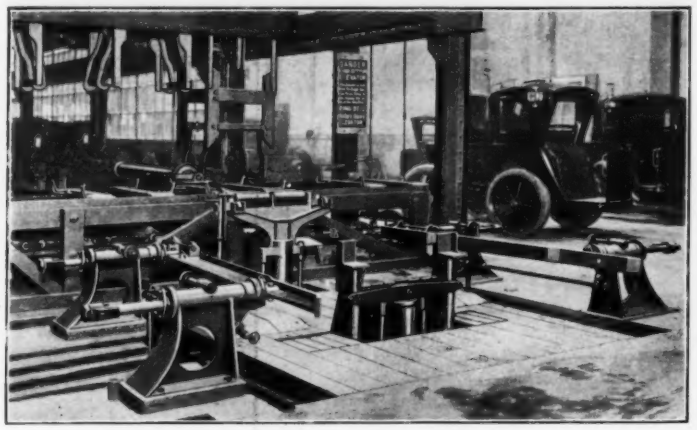


FIG. 11.—VEHICLE PLATFORM SHOWING CENTRING AND LIFTING APPARATUS.

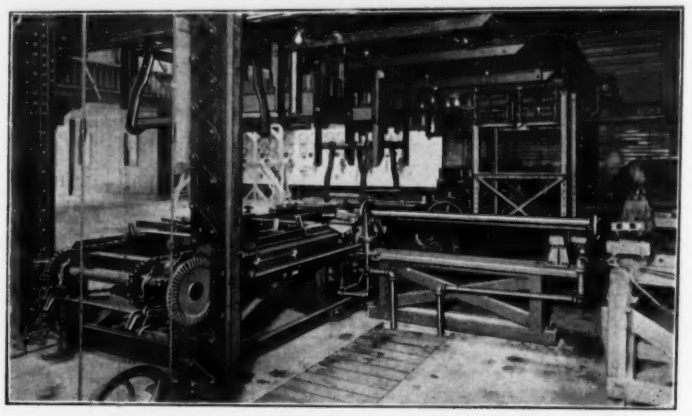


FIG. 12.—CRANE AND CONVEYOR TABLE FROM BEHIND, SHOWING PUSH AND PULL CYLINDER.

spanning the battery charging room and carrying, instead of a trolley, eight hooks or grabs, shown clearly in Figs. 9, 10 and 12. Any one of these hooks may be made to descend and catch under the two sides of the battery tray and lift the latter to a level immediately below the crane bridge. One tray is so shown in Fig. 10. The crane then moves as a whole down the length of the battery room to a position over the battery charging table on which it is desired to deposit the tray. In lowering the hooks the tray is deposited, its own weight closing the contacts for charging its cells, as described above and shown in Fig. 5. The crane may be then removed to any other position, its eight hooks moving respectively over the eight rows of charging tables up and down the room and enabling one tray of batteries to be picked up from any one of these rows each time it passes over them. Returning to the position over the conveyor table the batteries may be lowered onto the latter and moved along until they arrive at a position opposite the vehicle to be loaded, when they are in turn pushed in by the same hydraulic cylinder which pulls the exhausted sets out. There are two platforms on which the vehicles can approach the conveyor table, and, the capacity of the crane being several sets of batteries with which it can be fully loaded before it moves back over the charging tables, returning again with several fresh batteries, it is expected that the accumulators in any carriage can be replaced inside of three minutes' time and a capacity of about twenty carriages per hour can be obtained. Carriages have already been loaded in three and one-half minutes.

The various movements of the conveyor table, crane, hoist, etc., are effected by electric motors, all of which, some fourteen in number, are of the same make and size, 5 horse-power, so that their parts are interchangeable. The conveyor table and bridge mechanism of the crane are each fitted wih a reserve motor for emergency use. Beside the two loading platforms in front of the conveyor table there is a third in reserve fitted to unload onto a small car, on which the batteries can be wheeled under any hook of the crane. The whole plant is interlocking, the conveyor table motor being inoperative when the conveying chains are latched, the bridge travel motor being inoperative when the bridge is latched, and also when any one of the hooks is down. Everything can be manipulated from one platform which hangs from the crane to a position near the ground, running in an aisle down the middle of the battery room. A man is shown standing in this platform in Figs. 9 and 10. When the crane has advanced to a position over the conveyor table, the controlling handles of the latter and the valve spindles of the various hydraulic cylinders are within easy reach from the platform, so that one man alone can handle the

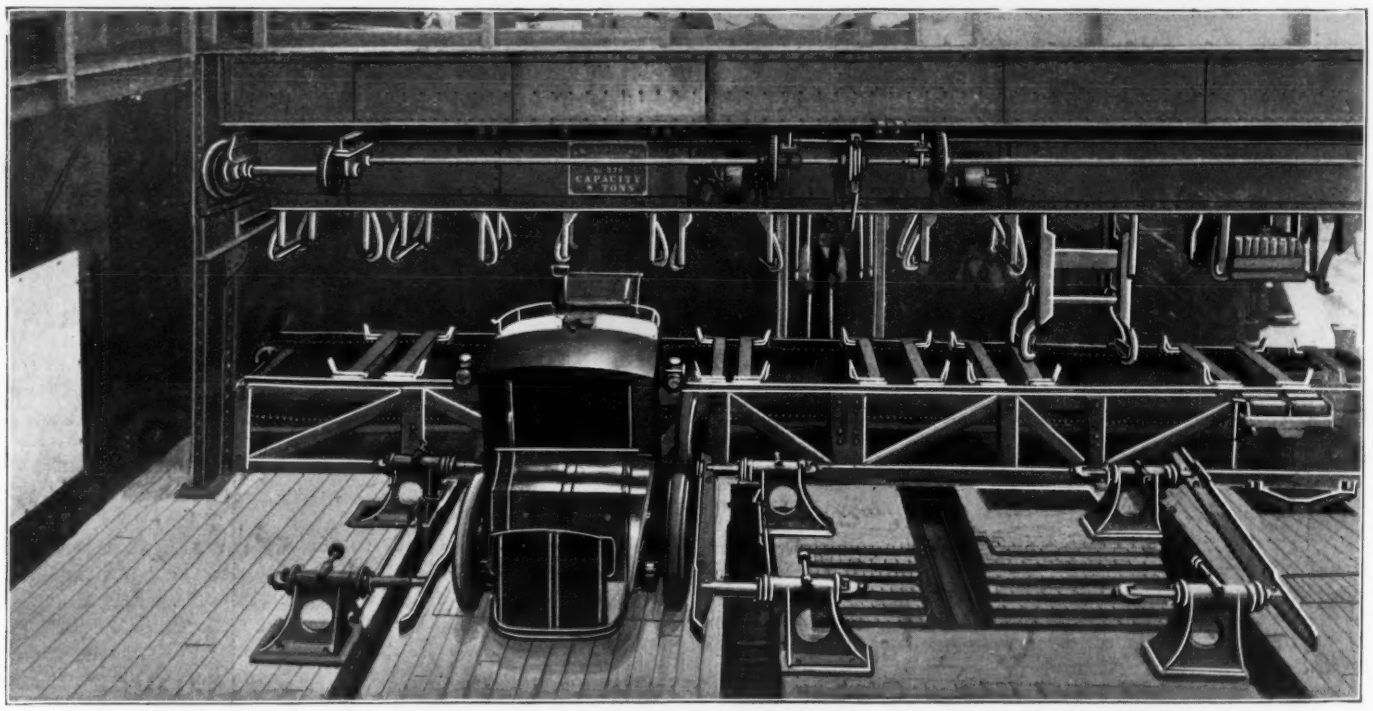


FIG. 9.—VIEW OF CRANE, CONVEYOR TABLE AND VEHICLE PLATFORM FROM THE GALLERY.

batteries from the vehicle to the charging tables. The various movements are well equipped with braking mechanisms, the hoists and conveyor table having electric brakes and the bridge travel a hand brake. The conveyor table is also fitted with limit stop switches, so that if the attendant is careless and leaves the conveyor running, in which case the trays thereon would be tipped off the end, the switch arm is struck by the battery tray which cuts off the current and applies the electric brake.

Water pressure for the various hydraulic cylinders is supplied by a triplex pump belted to a motor similar to those used on the crane, conveyor table, etc. A 36-inch tank about 9 feet high gives an ample air cushion, the water pressure being 150 pounds to the square inch. A Mason by-pass valve is now in use to prevent the pressure rising too high, but there will be substituted for this an automatic motor controller which will start and stop the motor at such times as to maintain the proper water pressure.

The work was designed and carried out under the direction of Mr. G. Herbert Condict, who previously had similar experience in designing the charging station of the Chicago & Englewood storage battery railway. Mr. Condict was assisted in this work by Mr. A. W. Gilbert, who acted as superintendent of construction.

The main feature of the work were supplied or carried out by the following concerns: structural steel work, Edgemore Bridge Company; crane and special hydraulic and transfer table work, William Sellers & Co., Philadelphia; motors, Westinghouse Electric & Manufacturing Company; boosters, Western Electric Company; main switchboard, Albert & J. M. Anderson Manufacturing Company; storage batteries, Electric Storage Battery Company; electric elevators, George T. McLauthlin Company; exhaust plant, B. F. Sturtevant Company; indicator boards, the Electro-Dynamic Company; rheostats, Ward Leonard Electric Company; circuit breakers, Cutter Electrical and Manufacturing Company; vehicle wire and charging cables, the Okonite Company; pumps, Goulds Manufacturing Company; vehicle bodies, Specialty Carriage Company; running gear, P. H. Morris, Philadelphia. There were in all over forty contractors connected with the work.

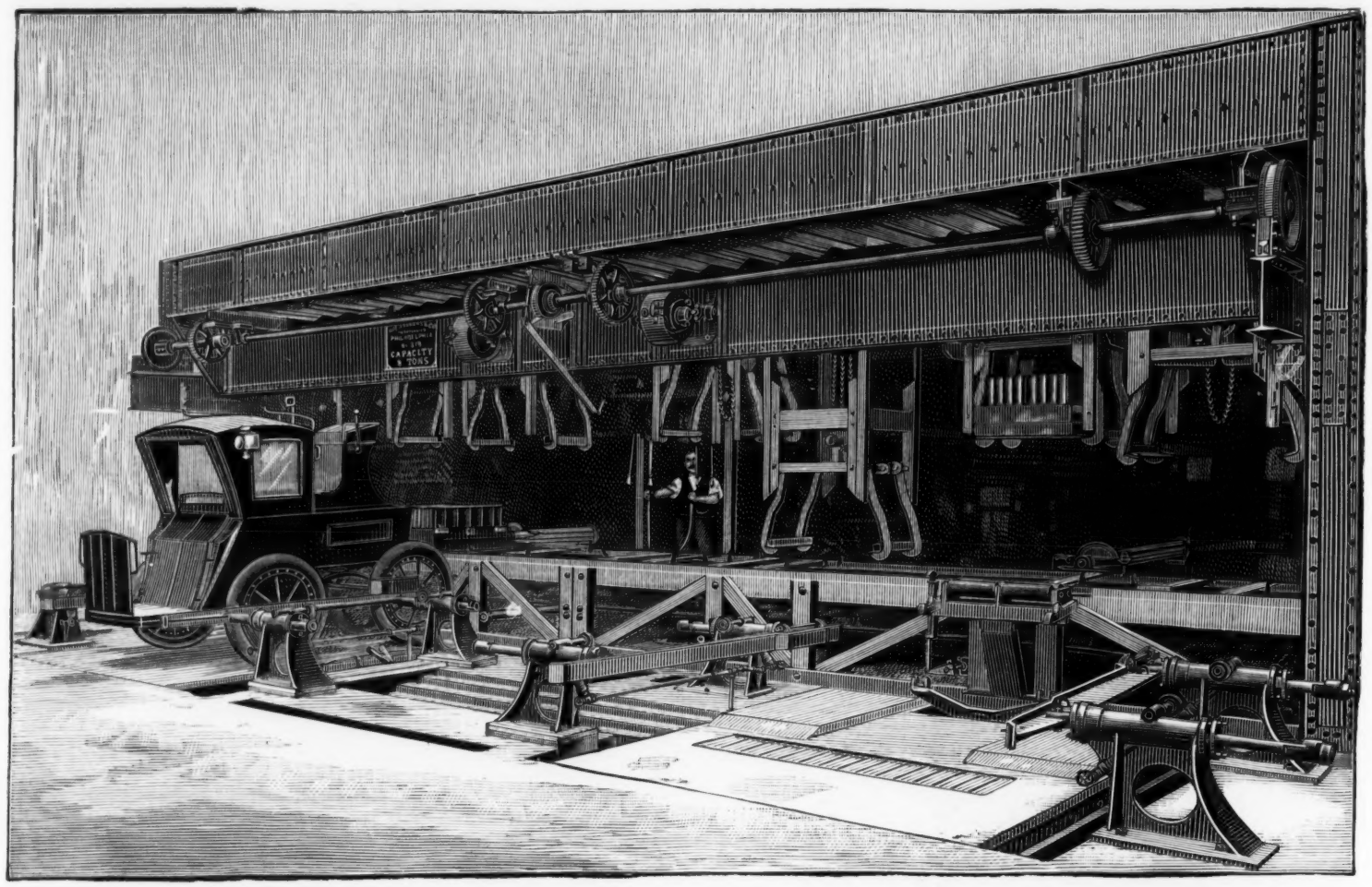


Fig. 10.—View Showing Hansom on One Platform, Its Battery on the Conveyor Table, and Another Battery in the Crane.

## Electrical Education for All Engineers.

The following is a brief abstract of the paper, read at the recent meeting of the Society for the Promotion of Engineering Education, on "Electricity in Engineering Courses Other than Electrical," by J. P. Jackson, professor of electrical engineering, Pennsylvania State College:

The present extended use of electricity in industrial undertakings has made a knowledge of its control indispensable to the well-rounded engineer.

College courses preparing for the older engineering professions were established while electricity was of small service. Through human inertia these courses have tended to continue on their old lines. The present time, therefore, finds training in electricity far from satisfactory in engineering courses other than electrical.

The work usually assigned is the electricity and magnetism of the general college physics course, with possibly one term on its applications. No time is given to a vigorous advanced treatment of the subject from an engineering standpoint. The college physics course might as well be depended upon to give the requisite training in applied mechanics or thermodynamics.

In addition to the work now usually scheduled, a thorough training in the laws of direct and alternating currents, as they apply to the practical utilization of electricity, should be added. This should be taught by an engineer, and should be assigned time comparable to that given the steam engine, hydraulics and hydraulic machinery, etc. This time could be obtained with advantage by cutting out special work. An outline of such a course is included in the paper.

As scientific knowledge increases, engineering courses must give more time to fundamental principles at the expense of mere technical practice. Hence such courses tend to converge.

If electrical engineering studies are to be satisfactory they must be under the supervision of an engineering department, and should not be taught by instructors in the departments of physics.

## The Mechanicville-Schenectady Power-Transmission Plant.

At a point on the upper Hudson River, near Mechanicville, N. Y., there has been under construction during the past year an admirably designed plant for the development of the water power there available and its transmission electrically to distant points.* The site is only 2 miles from Mechanicville, 11 miles from Troy and 18 miles from Albany, in each of which places large quantities of power will without doubt find a market. But most important of all, it is only 17 miles from Schenectady, where, covering not less than 130 acres of ground, the largest electrical works in the world are operated from an extensive steam plant with which the electrical power from the Mechanicville cataract can readily compete.

A point was chosen for the hydraulic development where the physical conditions were ideal for a dam and power house. The banks and bottom of the river are of rock, as is Bluff Island, which divides the Hudson into two channels, and here during the greater part of the year is water sufficient to produce from 7000 to 10,000 horse-power.

The island is about one-third of the distance across the river from the western bank, the combined width of the two channels being about 1200 feet. The western channel is used for the head and tail races.

### DAMS.

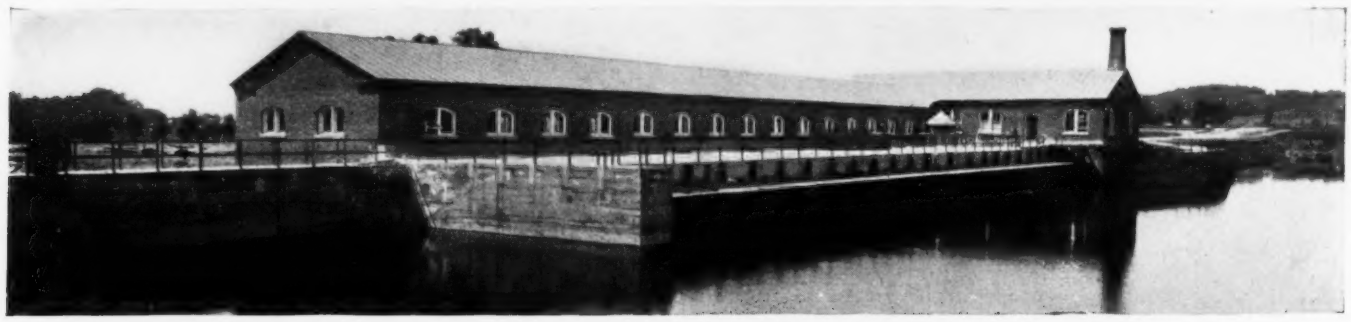
The power house starts from the west bank and extends out into the river about 215 feet and is connected with Bluff Island by a concrete dam, 26 feet high above the bed of the river, 10 feet wide on top and 18 feet wide at the base. The upstream face is vertical and the downstream face sloping. The top of this dam is at an elevation considerably above the spillway; thus no provision is made to take care of falling water on the downstream side, but the dam is provided with four arched waste gates 4 feet wide and 6 feet 9 inches high, operated in the same manner as those in the main dam.

THE MAIN DAM AND WASTE GATES.

*See also THE ELECTRICAL WORLD, November 13, 1897.

The main dam is on the eastern side of the island. It is built entirely of concrete, as indeed is the entire construction with the exception of the upper walls of the power house. The upstream face is vertical; the downstream face is curved and provided with a horizontal apron 14 feet wide, which throws the falling water off horizontally, and thus effectually prevents wash or scour of the toe of the dam. The dam is 16 feet high above the river bed, 8 feet thick immediately below the crest, 16 feet thick through the base and 30 feet thick through base and apron. The dam is set between massive abutments anchored to the rock sides of the river bank and island. The length of the spillway between abutments is 800 feet. In the western abutment are twelve arched waste gates, each 4 feet wide and 6 feet high, opened and closed by a hoist operated by a hand gear. The eastern dam is practically a solid rock wall, capable of safely resisting any flood. It was severely tested in the spring of 1898, when a flood of extraordinary proportion came against it, yet, notwithstanding the fact that the dam was green, the flood in no manner injured it. To prevent any floating rubbish, ice, or logs reaching the rocks or choking the waste gates, a floating wooden boom stretches from the western end of the spillway diagonally for a distance of 400 feet to the edge of the normal river bank, and then for a distance of 1000 feet to the main embankment of the Mechanicville highway. It is anchored to a line of stone-filled cribs.

ONE OF THE FLUMES.

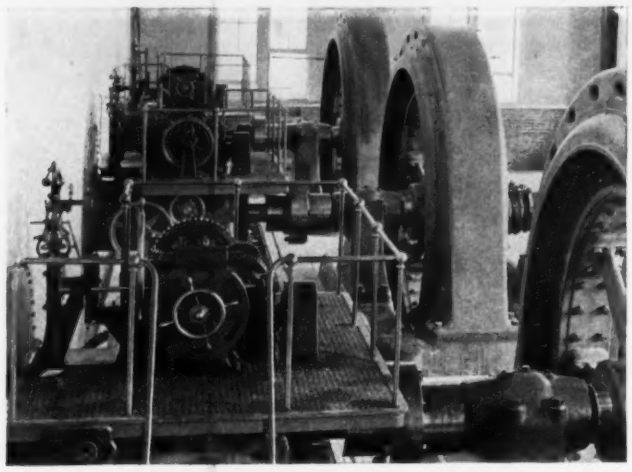


POWER HOUSE FROM UPSTREAM SIDE.

### THE POWER HOUSE.

The power house lies between the west bank and the short concrete dam, nearly filling the space between the island and the west bank of the river. It is practically a continuation of the dam, and like the latter is of concrete, with the exception of the upper walls. The foundations are carried down to bedrock, and the house is carried on heavy steel box web girders resting upon steel I beam columns. The latter are imbedded in concrete walls carrying

arches spanning the tail races and forming the floor of the generator room and the wheel flumes. The division walls form a separate and distinct tail race, 22 feet wide, for each set of turbines,



The Wheel Governors.

from which the water may be shut out at will. The house is divided into two parts by a thick head wall. The upstream part contains wheel chambers for seven 1000-hp wheels, of which five are at present occupied, and also for two exciter wheels. The downstream portion contains the wheel governors and the electrical apparatus. The length of the power house proper is 257 feet; the width of the dynamo room between head wall and south wall 34 feet, and the width of the wheel chamber portion 32 feet. At the western end an extension built of brick runs up stream about 87 feet. A retaining wall runs down stream from the power house along the western bank a distance of 50 feet. The western stream running between the bank and the island forms the forebay, 300 feet long. The main tail race is 205 feet wide and joins the main stream 750 feet below the power house.

A 20-ton crane runs the entire length of the dynamo room.

In front of the wheel chambers and running the entire length of the power house is a trash rack of steel bars supported on a frame work of steel channel and I beams.

### WATER WHEELS.

Each main turbine consists of two pairs of 42-inch horizontal Victor turbines, built by the Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio. The rating of each set of four wheels under an 18-foot head is 1000 horse-power.

The turbines for each exciter consist of three 18-inch Victor cylinder gate wheels (arranged as one pair with a central discharge and one single wheel), having at 259 revolutions per minute a total of 300 horse-power. The quarter-turn draft tubes of the single wheels are brought through the wall beneath the station switchboard.

Two draft tubes lead from each main turbine, each pair of wheels having a common central discharge, the forward tube descending straight into the tail race beneath the flume, the upstream tube curving downstream and flaring outward.

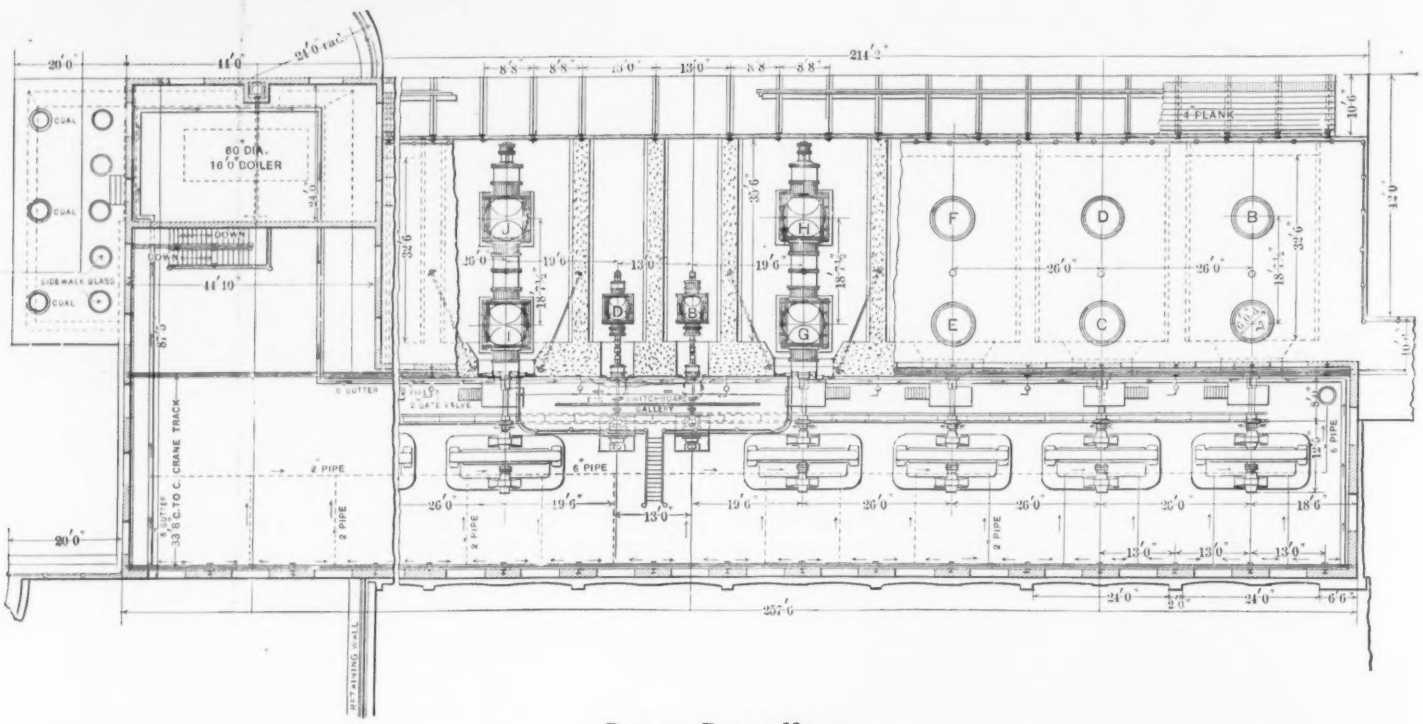
### WHEEL GOVERNORS.

The speed of each set of main wheels is regulated by a Geisler electro-mechanical governor, mounted on a platform directly over the turbine shaft, and between the head wall and the generator. The gates can be moved through their full travel, should the full current be thrown on or off, in six seconds.

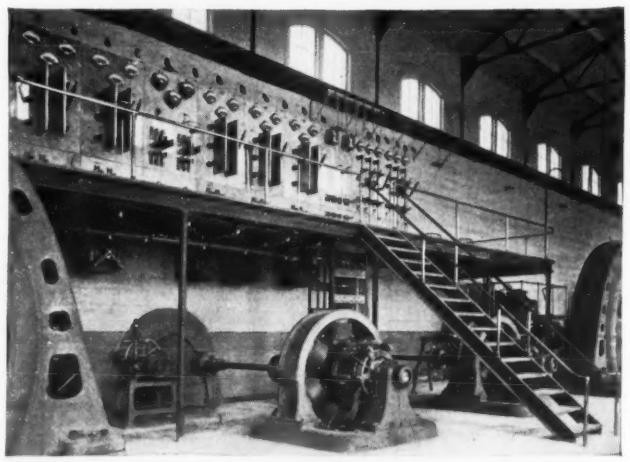
The governors controlling the exciter-wheel gates are improved "Snow" governors, which rapidly bring the speed to normal when changes are neither frequent nor heavy.

### GENERATORS.

The generators are unitooth, three-phase, forty-pole, 750-kw General Electric Company machines, having internal revolving fields and stationary armatures, and wound to deliver 36 amperes of current at a periodicity of 38 cycles and a pressure of 12,000 volts to the transmission lines when running at 114 r. p. m.




Plan of Power House.



Switchboard and Exciters.

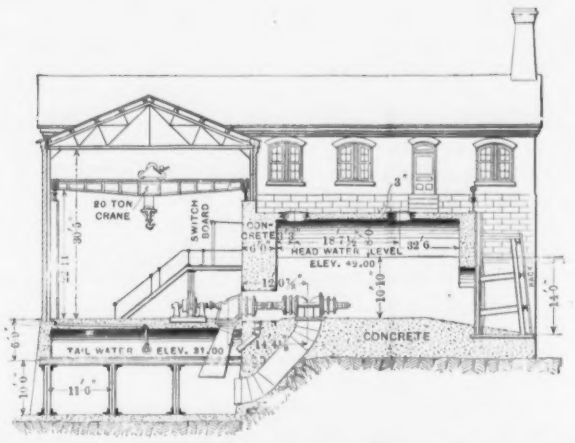
The alternators are similar in their main characteristics to those successfully used in the development of the power of the Lachine Rapids at Montreal.* The armature frame or ring is of the box

*See The Electrical World, October 2, 1897.

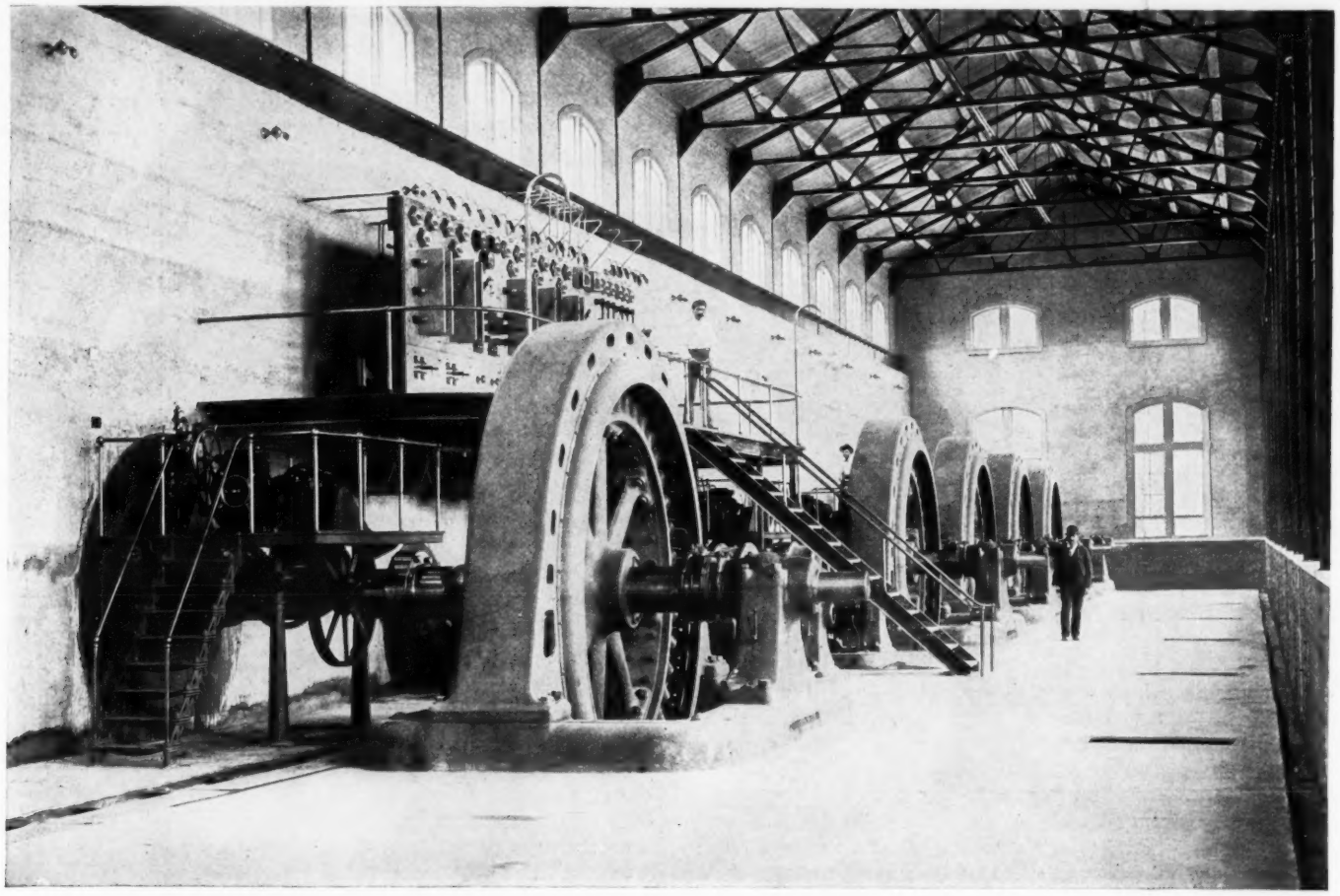
type, 15 feet 4 inches in diameter and 36 inches wide. It is bolted to a base, along which it may be moved parallel with the shaft, in order that the revolving field spider and poles may be uncovered should occasion arise. The armature winding is protected on each side by iron shields.

The field ring carries forty poles and revolves on a shaft 15 inches in diameter, coupled rigidly to the turbine shaft. The dynamo shaft is extended at the other end for coupling to a vertical steam engine in case of necessity.

The following reasons for selecting this type of alternator have been given by Mr. C. P. Steinmetz, of the General Electric Company. In addition to the advantage which the stationary armature type has over the stationary field type in allowing a high-transmission voltage to be taken directly from the armatures, it allows of a fairly low saturation of the magnetic circuit, giving an almost straight saturation curve. This is preferable in power transmission, since a considerable increase in the voltage may be obtained if needed to cover excessive drop in the lines due to heavy loads, and the voltage may be maintained even if the speed remains low.




SECTIONAL ELEVATION THROUGH POWER HOUSE, SHOWING EXCITER AND WHEELS.



THE DYNAMO ROOM.

The exciters are placed one on each side of the stairway leading to the switchboard gallery. They are six-pole, 100-kw, 125-volt standard General Electric machines, with ribbed field frame and toothed core armatures.

### SWITCHBOARD.

The switchboard, erected on a gallery along the north wall of the dynamo room, is built up of nine panels of blue Vermont marble. Of these nine panels, five are used for the generators and two for the feeders, one is the total output panel and the ninth is fitted for the control of the exciters. The generator panels occupy the left end of the board, and room on the gallery is left for two additional panels. The feeder panels are on the right end; the total output panel is between these and the generator panels and the exciter panel is the third panel from the left-hand end of the board.

Each generator panel is equipped with the following instruments: one inclined coil alternating ammeter reading to 75 amperes for the main current, and one direct-current ammeter reading to 150 amperes for the field exciting current. Above each of these is a pilot lamp and between the pilot lamps is a synchronizing lamp. Beneath the two ammeters is an inclined-coil voltmeter reading to 15,000 volts, and beneath this instrument are three single-blade, double-throw, quick-break, high-tension switches, each mounted upon corrugated cones of hard rubber. Similar studs support the bus bars. The corrugations give a total distance of about 8 inches between the metal and the surface of the marble on each side. As these switches are to break current of 12,000 volts they are tested by opening circuits carrying 21,000 volts. The switches are without handles. An eye is made in the end of each blade into which a hook at the end of a stick may be inserted and the switch opened by the attendant from a safe distance. Further, to prevent any jumping from blade to blade marble barriers are placed between them. On the back of the panels are the high-tension fuse blocks, which, designed for 20,000 volts, are of the snap-break expulsion type. These blocks are removable as a whole, and are fitted with blades which connect them with terminal clips supported from the panel by hard-rubber studs, 3½ inches high. The aluminum fuse is held tightly in the block between two pivoted arms attached to springs which put a strong tension on the fuse. As soon as the fuse melts its two halves are pulled apart, and thus the duration of the arc is minimized.

The field rheostats are hung beneath the gallery and are operated through gears. The panel for the two exciters carries two

pilot lamps, two circular dial, 1000-ampere ammeters, one voltmeter reading to 150 volts, one four-position voltmeter switch, one synchronizing switch, two 800-ampere, triple-pole, double-throw main switches and two packed card rheostats.

The two feeder panels are similar to each other in every respect. Each outgoing line is provided with an independent ammeter reading to 150 amperes and a quick-break, double-throw, high-tension switch, similar to those on the generator panels, and similarly mounted on the board. Mounted also on corrugated hard-rubber supports are the six circuit breakers or automatic plunger switches. These consist simply of long copper rods capable of sliding lengthwise in vertical rubber tubes. Each is held by a trigger and forced downward suddenly, when released, by a strong helical spring, opening the circuit at its upper end. The triggers are actuated by a rock arm, so that all three poles may be opened simultaneously.

On the upper part of each feeder panel are also two single-phase integrating wattmeters and the current and potential transformers therefor.

On the front of the output panel are two Thomson integrating wattmeters for balanced three-phase circuits, each reading to 300 amperes and 12,000 volts, and twelve triple-pole, single-throw, 100-ampere switches with fuses for the lighting and heating circuits of the power house.

The line is protected by double-pole, 2000-volt, short-gap lightning arresters, connected six in series to give the necessary number of spark gaps, which are each one-thirty-second inch long. They are placed in a small house, 15 feet square, near the first pole, the line running underground from the power station to the arrester house.

The lead covered leads from the generators are laid in ducts in the floor. Rubber-covered wire is used for the field connections. The cables rise on a frame from the duct to the floor of the gallery through which they rise to the board. From the back of the board the line wires rise to supports bolted to the I beam on the north wall, which supports one of the crane runways.

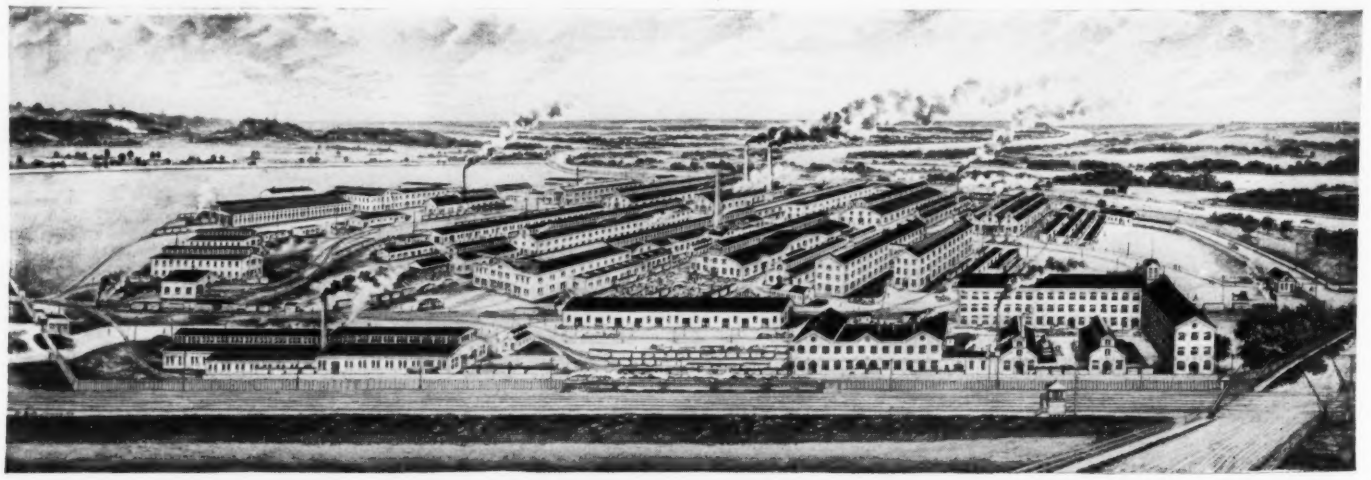
The line from Mechanicville to Schenectady is the only one at present laid down. It consists of three No. 000 B & S gauge bare wires. The circuits are carried on poles, 30 to 60 feet long, and all 8 inches in diameter at the top. Each pole carries one cross arm, on one side of which are two porcelain insulators of the triple-petticoated type, a third being on the other side. For lightning protection a barbed wire, frequently grounded, runs along the tops of the poles.

The line takes a westerly direction to East Glenville and then due south to Schenectady. At the end of the Glenville bridge over the Mohawk River it is carried down to the ground and connected to three cables of No. 1 gauge, stranded copper, insulated by one-quarter-inch rubber and three-thirty-seconds lead sheet, laid in three separate ducts of terra-cotta conduits. These cables run 1700 feet, after which the line rises to poles again and continues to the works of the General Electric Company.

The introduction of this transmitted electrical power into the factory will work a considerable change. At present all the machinery is driven by electric motors, while the testing department demands an independent supply of current for the work it carries on. There are, therefore, two distinct generating plants. The 550-volt motors in the testing department are supplied from an engine-driven, multipolar generator, of 500-kw capacity, while a smaller engine drives a number of exciters, which allow of independent control of the excitation of all machines in this department. The factory is operated by a number of 250-volt motors running on the same circuit as the factory lights. These motors will not be changed and the steam plant which supplies them will be retained as a reserve in case the power from Mechanicville should fail.

The large engine driving the 500-kw multipolar generator will be replaced by a 500-kw synchronous motor coupled to a direct-current generator. This motor is a twelve-pole, 400-revolution machine of the revolving field type, wound to take 10,000 volts direct. The small engine driving the exciters is to be replaced by a 100-kw synchronous motor—an eight-pole, 600 r. p. m. revolving field machine similarly wound. This disposition renders this department independent of everything but the speed of the Mechanicville generators, which will be kept as nearly as possible constant.

The three rotaries supplying 250-volt current to the factory motors are ten-pole, 400-kw, 480 r. p. m. machines, having two commutators and two sets of collector rings connected to two independent windings on the armature. The commutators at each end are, of course, inside the main bearings, but the collector rings overhang the latter. They receive the three-phase current from independent secondary coils of the same set of air blast transformers. When the two commutators are connected in multiple they furnish direct current at a normal pressure of 250 volts, but as they may be called upon to furnish current to the testing department in case the demand exceeds the supply from the synchronous motor driven machine, they may be connected in series to give 500-volt current, operating in parallel with the railway generator, driven by the synchronous motor in the testing department.



The Works of the General Electric Company at Schenectady.

The rotaries will normally be operated in parallel at 250 volts, and all the factory motors, the factory railway and all the factory lighting will be operated from the same direct-current circuit, the latter on the three-wire system, the neutral of the three-wire system being secured by connecting the secondaries of the step-down transformers feeding the rotaries in Y, the common point of which gives a balanced voltage between the direct-current terminals.

The entire construction of the dams, power house and lines has been carried out by the National Contracting Company, of which G. M. Furman is general manager, E. A. Mathews superintendent, and J. A. Leonard constructing engineer. The electrical equipment is furnished by the General Electric Company and the hydraulic equipment by the Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, to which company was confided the entire development contract. It took the Hudson River in its natural condition and turned over to the operating company the plant in running order.

The officers of the Hudson River Power Transmission Company are: Gen. Edmund Hayes, of Buffalo, N.Y., president; R. N. King, president of Stilwell-Bierce & Smith Vaile Company, of Dayton, Ohio, vice-president; G. M. Furman, Newark, N. J., treasurer; Mr. E. J. Richards, Boston, Mass., superintendent; J. S. O'Shea, manager.

## The Meter's Relation to the Dividend.*

BY CARYL D. HASKINS.

The meter's relation to the dividend is partly, of course, a very obvious relation, but I have been surprised in going from plant to plant and from place to place to find how many central stations throughout the country have overlooked the fact that in the mere matter of the careful disposition and management of meters lies all of the difference between financial success and failure.

A good many central stations in the past have confined themselves to the question of accuracy on what they deemed would be the average load of the meter. While no doubt that test is better that none, it really means very little. The next step has been the testing of the meter to see on what load it will start. The load on which a meter will start to rotate is of almost no importance. A meter may start on 2 per cent. of its rated capacity, and yet may be running 90 per cent. slow, and is not as good a meter as the one which won't start until it gets within 3 or 4 per cent. of its rated capacity, but when once started will run with approximate accuracy.

I have come to appreciate that the most important thing of all to look for, the thing which will make the treasurer look happiest at the end of the year, is the proper action on overload. A great error that central station managements have made in the past is the use of meters too big for the work. If a meter is used which is good on overloads, and is accurate until it burns up, phenomenal accuracy on low loads is not essential. The meter which is extremely accurate on low loads is not to-day a hard meter to find, but a rather hard meter to maintain. The low load is the load that friction, dust, dirt, wear and age affect; and what is wanted to-day in every installation is that meter which will carry the load, frequently working on an overload perhaps, and seldom working on a very low load.

When possible it is a good thing to avoid working meters at much less than 10 per cent. of their rated capacity. Of course this is not always possible; but more often possible than one would think at first sight, or upon hasty investigation. I admit that next in importance to overload accuracy in a meter comes the light-load accuracy; for the simple reason that light loads cannot always be avoided.

The third feature to investigate with care is the inductive-load accuracy.

These three factors are perhaps being looked into pretty carefully now by 75 per cent. of our stations. Almost every station, however, stops at that point. Very few stations investigate accuracy on changes of frequency, accuracy on changes of wave form. Almost every one has to face a change in frequency sooner or later; and the bulk of meters to-day are weak at that point. A meter which must be changed if the frequency of the system is altered, or a meter which cannot be changed from a 60-cycle machine to a 125-cycle machine, or vice versa, is not a profitable piece of apparatus to have, and ought to be avoided. The wave-form question is one which has not been appreciated very long; but obviously it is not a good thing to have meters which will run within 1 per cent. of accuracy on a smooth-core armature and a different percentage on a toothed-core armature; yet many meters vary materially between these conditions.

I have placed all of these technical considerations before another, which perhaps has also been passed over too lightly in the past; and that is the mechanical construction of the meter and its ability to withstand punishment. I can class with that portion of the treatment of the subject the question of damping magnets. The speed of the meter changes as the square of any change in the damping magnet strength; in other words, a slight change in the strength of the damping magnet will change the speed of the meter as the square of that change in the magnet. That emphasizes immediately the importance of having really permanent damping magnets. If they are exposed to unusually high or fluctuating temperatures, as in an attic under a tin roof, their strength falls, as it does also under severe vibration.

The jewel is also a point which should be looked into with care. Sapphire jewels are the commonest bearing to-day. The sapphire is really the only substance which is fit for a meter bearing; it is next to the diamond in hardness, and yet is peculiarly smooth on its polished surface, and in that respect differs from diamond, which is apt to be gritty and rough. The sapphire which comes from Arizona is not more than one-half as hard as the sapphire which comes from Ceylon.

Generally speaking, lighter colored and whiter sapphires make the best bearings. A rigid mount is not the best for jewels, since they are worn away not so much by the rotation of the shaft as by its reciprocating motion. Imperceptible though it may be, it is always there; and it is this hammering motion which breaks up the surface of the jewel and establishes that gritty foundation which means death to the bearing. The moment the outer skin of the polish on a jewel is broken the jewel is on the road to destruction.

Low speed is much better than high for a meter. A jewel will wear a good deal longer proportionately on a low-speed than a fast; in other words, the jewel which will wear on an average 2,000,000 revolutions at a speed of 40 revolutions per minute will not wear for 2,000,000 revolutions at a speed two or three times greater. About 2,000,000 revolutions is the life that can be looked for from a good grade of sapphire meter jewel. This is true unless the meter is placed in position where there is a good deal of vibration, when it will have a shorter life. A good rigid point of installation in a basement, with no moving machinery, will show more; yet 2,000,000 is a fair average.

This leads me to the question of the installation of the meter. Many central station managers will take out and test their meters with the greatest of care, and use expert knowledge in determining what is the best meter to meet their conditions and yet sacrifice from 1 to 2 per cent. of their stockholders' money annually on the altar of improper installation. As I said before, most meters are too large for their work. It is better to put in too small a meter, even if one is occasionally lost by a burn-out, than it is to put it in one big enough for the maximum load, and lose revenue constantly on minimum loads.

It is, of course, a greater loss to have a meter running an hour on one hundred lamps at a speed of one-half of 1 per cent. slow than it is to have that same meter run for an hour on one lamp 25 per cent. slow. The accuracy on overloads, therefore, must be greater than that on the light loads. That is a point that is often missed. A good many people think that 5 per cent. is 5 per cent., forgetting that while 5 per cent. may not be at all serious on light load, it is death to dividends on high load or an overload.

In installing meters in theatres, hotels, and big installations generally, there has been in the past a very common error made in putting in only one meter. When that is done a lot of revenue is lost, owing to the theatre corridor or office lights, which are burning when the bulk of the house is idle. If the meter is big enough to carry the whole theatre or hotel installation on an ordinary overload, when ten, twelve or even twenty lights are run on that meter for a good many hours a day, a considerable percentage of that proportionately light load is lost. In all installations of that kind—theatres, hotels, halls—it is well to split up the circuits.

In installing meters avoid vibration. I have been in office buildings where every meter in the building was on a wooden partition, and where 50 per cent. of them were on partitions with banging doors. That means death to the jewels. It destroys light-load accuracy, because the jewels speedily become rough. If the meter has brushes it causes sparking at the commutator, which in turn increases the friction.

Considerable sacrifices in the wiring are justified to secure a suitable point of installation for the meter. A brick wall is good; the nearer the foundation the better. All kinds of pounding should be avoided, especially the vibration from moving machinery, which is the worst form of vibration to which a meter can be exposed. The price of a jewel is a small matter as compared with the loss which the company has to undergo from running meters on rough jewels. Much energy cannot be spared to make the meter a high-torque device, and friction must of necessity always be a considerable portion of the load which the meter carries in the work it does. This can be doubled, trebled or quadrupled by leaving a rough jewel beneath the lower bearing.

Places subject to high temperatures, or to sudden changes of temperature, ought to be avoided. Like very hard glass, jewels are liable to crack and break and flaw when the temperature changes; and it is probable that meters installed in garrets where the temperature sometimes goes as low as zero, and again as high as 100°, will not show anything like the accuracy at the end

*Abstract of paper read before the Ohio Electric Light Association, August, 1898.

of a year as will meters installed in situations where the temperature seldom goes below freezing point or rises above 90°. Again, the places where the temperature is constantly high are dangerous and hurtful, because by just so much do they lower the ability of your meter to carry overloads.

Another common error made in installing meters in connection with motors—and sometimes in connection with lights too—is the placing of the meter on the load side of the main switch. I suppose that is done with motives of economy, because when the main switch is open the energy which traverses the shunt coil of the meter is cut off. All meters which have shunt field coils must of necessity be wound with extremely fine wire. Every time the main switch is opened that fine wire cools off and contracts; every time that the main switch is closed that fine wire heats up and expands, and speedily the meter is open-circuited in the shunt field coil.

Until they have tried it, very few appreciate how easy it is to keep meters clean. With the average installation a visit to the meter for the purpose of cleaning twice a year is ample—sometimes three times a year where the point of installation is not a clean one. With a bellows all the loose dust which is liable to work into the bearings and enter the brushes and clock-train can be blown out. With a piece of tape a commutator meter can be cleaned in about a minute and a half. Altogether, the operation of cleaning out the meter should not consume more time at the meter itself than five minutes per visit—ten minutes a year! This is a very small sacrifice in wages to make for the return obtained owing to light-load accuracy. Sometimes people say to me, "but since we begun to clean our meters we began to get a lot of kicks." I think that tells the story at once. They began to get a lot of kicks because they had been running a long time with dirty meters.

As to testing meters, many stations have a practice of removing a meter to test it. They change their meters once a year. I don't believe it is necessary, except under very rare conditions, to remove a meter from the point of installation to test it. There are a good many simple and accurate ways of testing a meter at the point of installation which do not involve creating distrust in the mind of your customers. On direct-current service and also on alternating-current service where there are no inductive loads the method with ammeter and voltmeter is not to be despised; it is accurate, but is sometimes cumbersome. Better than that is the use of an indicating wattmeter, which when cut in with series coil in the field of the meter and potential coil in multiple with the armature of the meter gives an immediate indication of the watts in use. But even that method, I think, is inferior to one which is just beginning to come into favor, and which has proved a great success. That is nothing more than the use of a box of calibrated lamps. With a calibration card showing the consumption at various voltages and a voltmeter this gives good results. The lamps, if they are selected for a potential higher than that to which they are to be exposed, will retain their wattage for a surprisingly long time. It is also a method which appeals to the consumer. He knows what a lamp is. I have come to be a great believer in teaching the customer how to read and how to test his own meter. Meters are made pretty well to-day, and I think it is a good thing in the long run to have the customer so well armed with a very little simple information that he can turn on a number of lights in his house, and go down and watch the meter and satisfy himself that it is right.

Lately two entirely new propositions in connection with the meter problem have developed; and they have grown, I believe, up to a point where they will soon become the strongest kind of modifying influence on the earning capacity of the central station. I refer to the rate-modifying systems, such systems as the two-rate and the Wright demand.

The two-rate system is just what its name indicates. It is a system which, between certain hours of the day, changes the record of your meter from dial No. 1 to dial No. 2; and your customer pays on his high-rate dial one price for the current that he uses during the peak and on his low-rate dial another and much lower price for the current that he uses at other times than that of the peak. The determining of those two rates is strictly a local issue. Theoretically they should be determined by charging the peak customer the low rate plus his proportion, according to the amount he uses, of the interest, depreciation, and investment charges on the apparatus maintained for the purpose of carrying the peak alone. Some central stations have found it a possible and profitable basis to make the low rate about one-third of the high-rate or peak charge. It has been pointed out that after the system was established for a time the peak would change. That is just what is wanted. That hump should extend until the valleys are filled out, like grading a piece of ground.

There is a large class of customers who use light almost exclusively in the valley periods and who to-day, to a large extent, cannot be reached at all by electric light, for the simple reason that the rate is too high; but with the two-rate system gas rates can be met and strong inducements offered them.

It seems to me it is essential to the success of any multiple-rate system that the factor which changes the rate should be purely dependent on the occurrence of the station peak. There are systems which, instead of making the change of rate dependent upon the station peak, make it depend upon the local peak. If the local peak and station peak are coincident, this would be perfect, because it is somewhat a simpler system than the other; but the local peak is more commonly not coincident with the station peak than coincident with it. If the rate system makes the modifications depend upon the occurrence of a local peak, it seems to me that it punishes a class of customers who should be encouraged and not punished. If a very heavy load between 11 in the forenoon and 3 o'clock in the afternoon can be obtained, even though that load be a local peak, it is a profitable one. If a lot of distributed peaks can be obtained, overlapping one another and filling out the valley of the curve, it realizes what all central stations want to accomplish—a load curve which enables them to run as nearly as possible with the whole equipment at a fair load twenty-four hours a day.

The prepayment system is now being adopted in some cities, and will, I believe, be very widely used. It merely consists in a meter into which the customer drops his money in payment of his bill before he can get his light. It is simple, and in the large cities it seems destined to accomplish quite a revolution in electric light. It lets the illuminating company into whole sections of cities which to-day are closed from the mere fact that the people who take the light in those districts have no credit. They move every two weeks; and yet those people are the very ones who are the most extravagant in the expenditure of their money. They pay a high price for everything; and it has been proved quite conclusively in Europe that those people will use light in large quantities provided they pay for it in small installments. Such meters open up the slums of the larger cities, and even in smaller cities of the manufacturing class they open up great districts which to-day are either not available or not profitable, by reason of the great number of defaulted bills.

## A Comparison of the Single-Phase and Multiphase System.

In the abstract of a paper on this subject by Mr. Ernst J. Berg in the last issue of The Electrical World, and also in the editorial comment thereon, there is an opportunity for a misunderstanding of Mr. Berg's attitude on this subject. The subject of the paper, which was requested by the officers of the Ohio Electric Light Association, was "Long Distance Transmission of Power," but Mr. Berg specifically limited himself, on account of the nature of the association, to the transmission of power for lighting or lighting and incidental motor use, and this limitation unfortunately was lost sight of in the abstract and comment in these columns. Mr. Berg recognizes the advantages of multiphase systems over the single phase for the transmission or distribution of electrical energy to motors or to loads consisting mainly of motors with incidental lighting, but reasons that these advantages diminish as the motor load diminishes and are more than outweighed by the disadvantages of poor regulation and the difficulties of balancing when the load consists, as do most central station loads, largely of lamps with an occasional motor. It would appear from the statements published in the last issue of The Electrical World that Mr. Berg did not consider the use of multiphase systems advisable except for transmission to extremely great distances or for the supply of rotary converters. This is the case when and only when the load is largely a lighting load. Cases where the load consists almost entirely of motors form another exception.

## Some Tests with an Induction Generator.*

BY A. F. M'KISSICK.

It has been pointed out by several engineers, especially by Mr. Charles P. Steinmetz, that an induction motor, driven mechanically at a speed above synchronism, will act as a generator, and that for its operation as a generator there must be connected to it either an alternator or a synchronous motor.

In an article published in THE ELECTRICAL WORLD January 21, 1893, by Mr. E. Danielson, the following experiment is described: "A three-phaser *A* of 50 volts (as measured from the neutral point to each of the brushes), and with a current capacity of about 60 amperes, sent current to a motor *B*, with inductive winding of about the same capacity. The motor, by means of a belt, ran a continuous-current dynamo, *C*, of 330 volts and 16 amperes. The matters were reversed so that dynamo *C*, fed from a 330-volt circuit, ran the motor *B* as a generator, sending a rotary current to the three-phaser *A*, which then became a motor. The belt was then thrown off of *A*, and trials were made to break it out of step with the current, but without success."

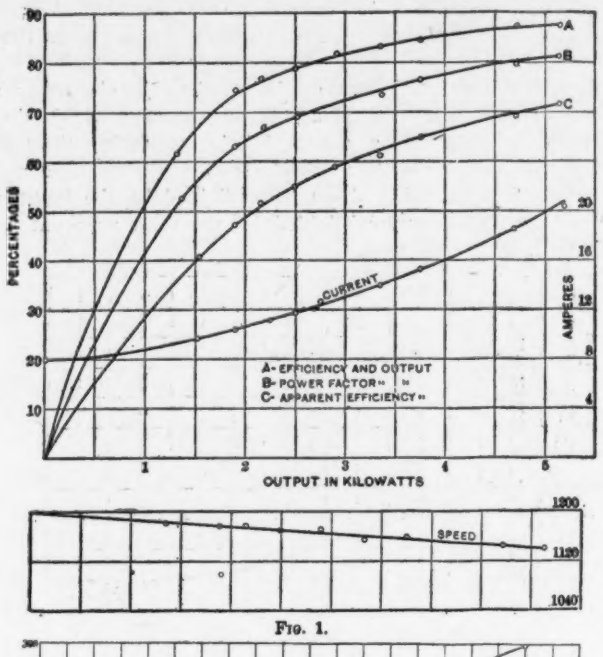



FIG. 1.

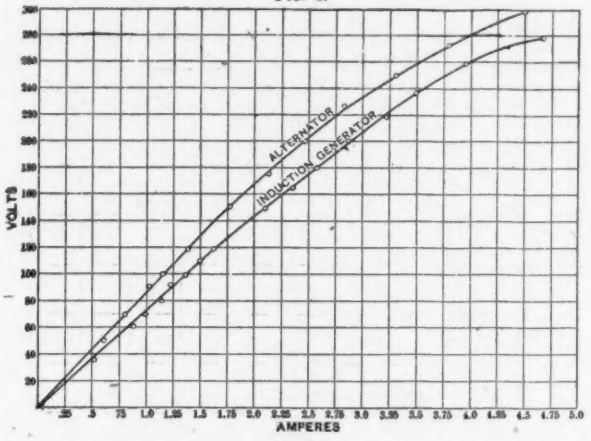



FIG. 2.

Again in the excellent paper of Mr. Charles P. Steinmetz on "Induction Motors," presented before the American Institute of Electrical Engineers on July 26, 1897, the use of an induction motor as a generator was referred to as follows: "As generator the induction machine differs from the synchronous alternating-current generator, or generator with constantly excited field, in so far as the latter can yield current and output at any power factor—that is, any phase displacement corresponding to the load—while in the induction generator at given terminal voltage to every value of current output a certain power factor of load corresponds. That is, to derive a certain value of current from the induction generator, the total load put on it must have the particular power factor corresponding to this current, and besides leading current, or if the power factor of the load changes, current and voltage of the induction generator will change accordingly. In consequence thereof, in general the induction generator is stable only if at least a part of the load consists of synchronous motors."

In the discussion that followed this paper Mr. Steinmetz speaks further of the induction generator as follows: "The induction generator is a very important piece of apparatus, I believe. It is, however, somewhat restricted in its application, due to the necessity of having as load a circuit-leading current. But whenever the conditions are such that it can be used, as for operating synchronous motors or rotary converters, this type of machine has the great advantage of the absolute absence of continuous current-exciting circuits, collector rings, or any other parts requiring attention. The voltage is generated in a stationary structure, and the revolving part is a solid structure of iron and copper bars. Furthermore, as soon as the circuit is opened or short circuited, the power is gone and the machine is dead, so that you get here a type of alternator requiring no attention whatever. Besides you can run it at different speeds and still get the same frequency out of it. There is another interesting feature noticeable when comparing the induction motor curves and the induction generator curves. The same machine as induction generator gives a considerably larger output electrically than as induction motor mechanically. In a future paper I shall dwell more particularly on the induction generator, and may mention here only that I have operated synchronous motors from an induction generator; the mechanical output from the synchronous motor driven by the induction generator was larger than the maximum mechanical output which could be derived from the same induction machine as induction motor."

The results of the tests made show close agreement with the theory as given by Mr. Steinmetz.

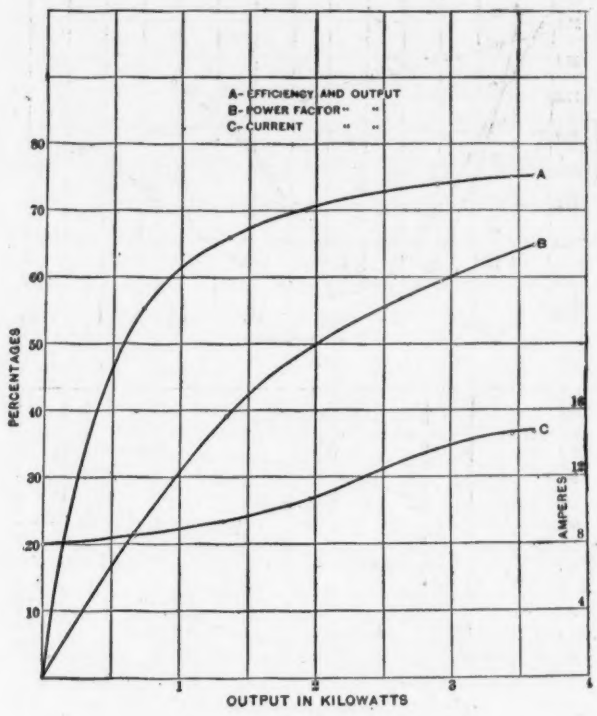



FIG. 3.

The tests described in this paper were made with a General Electric 5-hp, three-phase, 220-volt, six-pole, 60-cycle induction motor (with starting resistance in secondary rotating element), driven by a 10-hp. 110-volt Thomson-Houston direct-current motor.

The machine used as an alternator and synchronous motor in the tests was an "Ideal" 5-kw, three-phase, 60-cycle, 10-pole, 220-volt machine, and could be belted either to a jack-shaft or to a three-kw Edison 125-volt dynamo.

The curves in Fig. 1 show the operation of the induction machine as a motor with varying output.

In the tests under this head the belt connecting the Ideal alternator to the jack-shaft was in each case thrown off after starting and the alternator run as a synchronous motor, either empty or driving the 3-kw Edison dynamo.

### CURVE OF MAGNETIZATION.

The method of making this test is as follows: Start induction motor from Ideal alternator, the 10-hp direct-cur-

*A paper presented at the general meeting of the American Institute of Electrical Engineers, Omaha, June, 1898.

rent motor being belted to the induction machine when up to speed, supply current to 10-hp direct-current motor, driving induction machine near synchronism, and throw off belt connecting alternator to jack-shaft. This alternator will then run as a synchronous motor, receiving its current from the induction machine, which is now being driven as a generator by the 10-hp, direct-current motor belted to it.

By varying the exciting field current of the synchronous motor the voltage of the induction generator is varied, and from the readings of field current in synchronous motor and voltage at terminals of induction generator, the curve marked "Induction generator" in Fig. 2 is obtained.

The magnetization of the Ideal alternator is also given in Fig. 2, which is almost identical with the magnetization curve of the induction generator.

TEST WITH INDUCTION GENERATOR DRIVING SYNCHRONOUS MOTOR LOADED.

In this test the alternator was made to run as a synchronous motor by the induction generator as before, and then belted to the 3-kw Edison, driving this machine as a dynamo.

The results of this test are shown in Fig. 3.

In making the calculations for efficiency the energy required for the excitation of the synchronous motor fields was charged up against the synchronous motor.

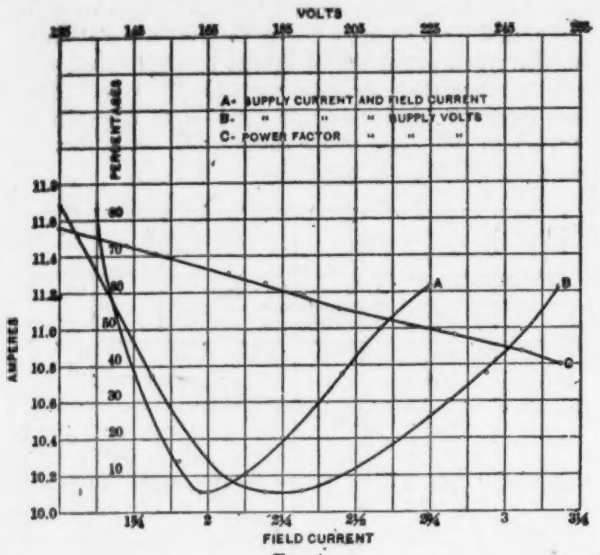



Fig. 4.

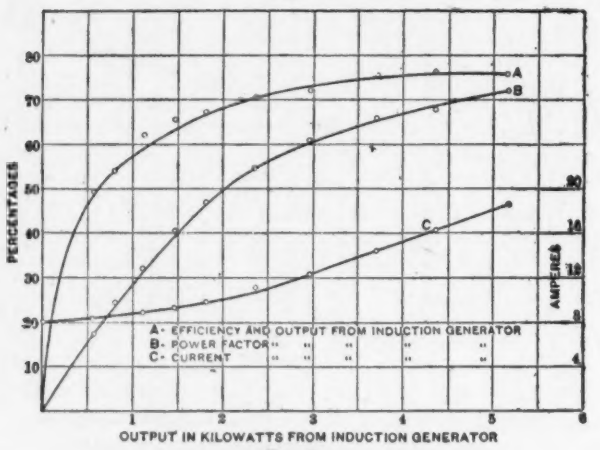

A- EFFICIENCY AND OUTPUT FROM INDUCTION GENERATOR
B- POWER FACTOR " " " " "
C- CURRENT " " " " "
PERCENTAGES
AMPERES
OUTPUT IN KILOWATTS FROM INDUCTION GENERATOR

Fig. 6

Fig. 4 gives the results of the following test: With the connections the same as in the preceding test, and the load on the 3-kw Edison maintained constant, the voltage of the induction generator was varied, and corresponding current, watt and speed readings recorded.

The voltage was varied from 260 to 125, the synchronous motor falling out of step on attempting to lower the voltage to 100.

Curve *A* gives the variation of supply current with field current, curve *B* variation of supply current with voltage of supply, and curve *C* is plotted between power factor and voltage of supply.

It is interesting to note the similarity between the general shape of curve *A* and the curve plotted between the same co-ordinate values as curve *A*, obtained from a synchronous motor with constant load, supplied with alternating current at a constant pressure, and also the similarity between the curves in Fig. 4 and those in Fig. 5, which were taken with the induction machine run as a motor, the load being kept constant on the motor, but the supply voltage varied.

It will also be noted that in both tests the power factor increased uniformly with decrease of voltage.

TEST OF INDUCTION GENERATOR WITH LAMP LOAD.

The induction generator was started as before, and a lamp load that could be varied put on, it, of course, being necessary to run the synchronous motor empty.

The load in lamps was varied from zero to the full load of the induction generator, with the results as shown in Figs. 6 and 7.

In calculating the results shown in Fig. 6 the watts supplied to the alternator running as a motor, and to the lamps, were taken as the output of the induction generator, the efficiency being this output divided by the input to the induction generator, and the power factor this output divided by the total apparent watts from the induction generator.

In Fig. 7 the fact that the energy delivered to the alternator and that required for the excitation of the alternator fields do no useful work is taken into account. So, in calculating the results in Fig. 7, the watts supplied to the lamps were considered as the output, the efficiency being this output divided by the input, and the power factor this output divided by the total apparent watts from the induction generator.

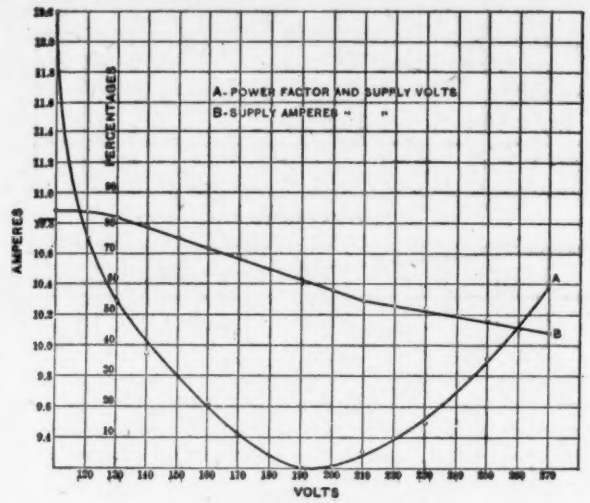



Fig. 5.

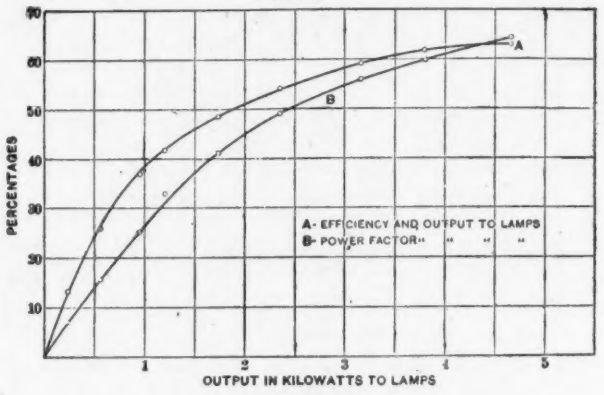



Fig. 7.

SYNCHRONOUS OPERATION OF ALTERNATOR.

The speed of the induction generator was varied, the voltage of supply being maintained constant, and corresponding readings of speed taken on alternator running as a synchronous motor, which showed that motor ran in synchronism with induction generator. The results are shown in Fig. 8, the full line representing the synchronous speed line, the small circles the points found from readings.

In all preceding tests the belt connecting alternator to jack-shaft was thrown off, after the starting up of the induction generator. In the tests below the belt connecting the Ideal alternator to the jack-shaft was not removed.

TEST OF INDUCTION GENERATOR, FURNISHING CURRENT TO ALTERNATOR.

The induction generator was started up as usual, and its speed gradually increased from below synchronism to about 6 per cent.

above synchronism, readings taken as usual. The alternator was therefore run as a motor and helped to drive the jack-shaft.

The results are plotted in Fig. 9, which will be found by comparison to resemble the curves constructed by Mr. Steinmetz.

It is interesting to note in connection with this test the readings on the two wattmeters, as shown in Fig. 10.

At the beginning of the test, before the induction motor was speeded up, readings were taken on the two wattmeters, and as the power factor was below 50 per cent. the reading on one wattmeter (No. 2) was negative, hence its connections had to be reversed, and while its connections were reversed the difference of the two wattmeter readings represented the total true watts. As soon as current was turned on the shunt motor (insufficient, however, to make this machine act as a motor and drive the induction machine) the load on the induction motor was decreased, the power factor decreased, and the corresponding wattmeter readings are shown in Fig. 10.

On furnishing sufficient potential to the shunt motor to make it act as a motor, and drive the induction motor as a generator, the readings on wattmeter No. 1 diminished and finally became negative (necessitating a changing of its connections), while the readings on wattmeter No. 2 continue to increase as shown, and al-

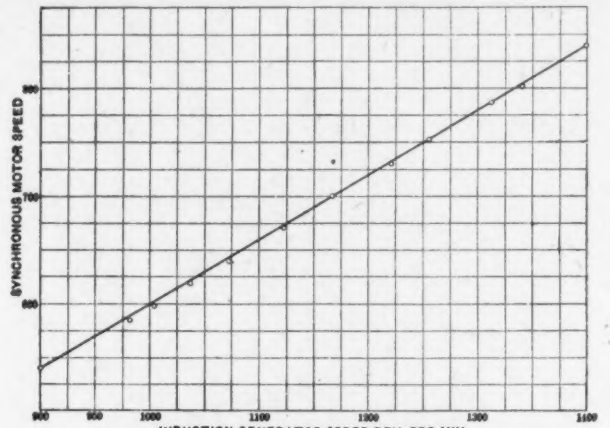



FIG. 8.

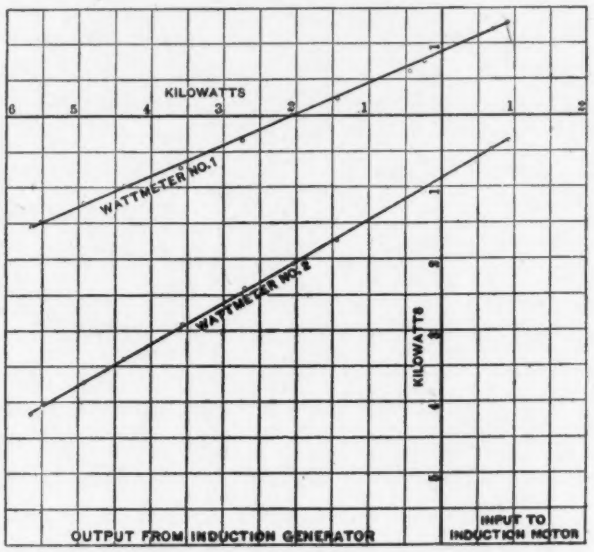



FIG. 10.

ways negative. Under these conditions, the total watts will be the sum of the two wattmeter readings, and as the sum is negative, the induction generator is supplying energy to the Ideal alternator.

TEST WITH INDUCTION GENERATOR FURNISHING CURRENT TO IDEAL ALTERNATOR AND TO A BANK OF LAMPS.

This test is the same as the preceding one, except that a bank of lamps is connected to the three-phase terminals. At the beginning of the test the alternator furnished current to both induction motor and lamps, when on speeding up the induction motor, now running as a generator, supplied current to both lamps and alternator, which acts as a motor helping to drive the jack-shaft.

The results of these tests are shown in Fig. 11.

Curve *B* is plotted with induction motor output as ordinates and number of revolutions per minute above synchronism as abscissæ. At first the output is negative, which indicates that the motor is receiving energy from the alternator; at 11 revolutions per minute above synchronism it commences to act as a generator, and at 22 revolutions it is furnishing energy to both alternator and lamps.

As pointed out by Mr. Steinmetz, the induction generator can be run at different speeds and still the same frequency obtained from it. For proof of this a small induction motor was connected in the above test to the three-phase mains and run with no load. Variation of the speed of the induction generator from synchronism to 20 per cent. above synchronism did not in any way affect the speed of the little induction motor, its speed remaining constant, which was almost synchronous with the Ideal alternator.

Of course the above will not hold true when the conditions are as described in Fig. 8.

On attempting to make some tests with this induction generator as a single-phase instead of a three-phase machine it was found that the current required by the motor when running as a synchronous motor (with belt connecting alternator to jack-shaft thrown off) was excessive, so that this test had to be abandoned.

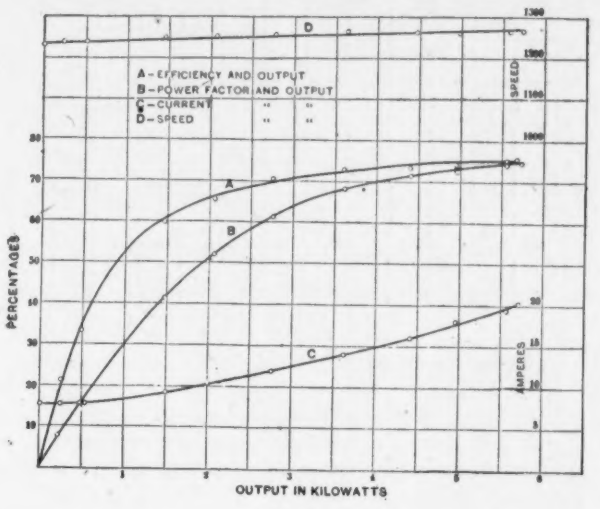



FIG. 9.

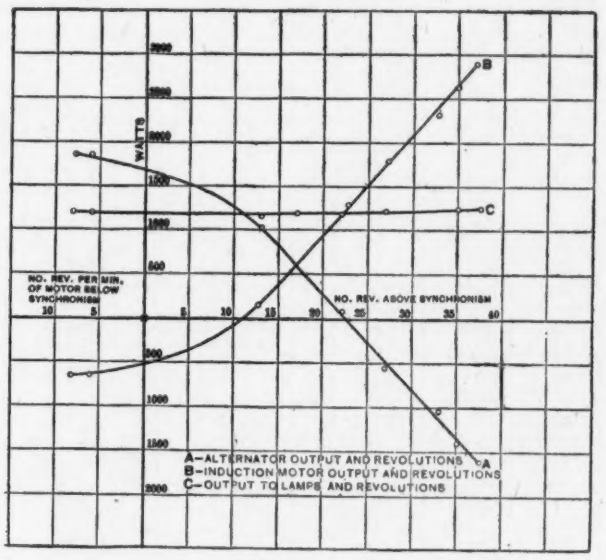

WATTS
NO. REV. PER MIN. OF MOTOR BELOW SYNCHRONISM
NO. REV. ABOVE SYNCHRONISM
A-ALTERNATOR OUTPUT AND REVOLUTIONS
B-INDUCTION MOTOR OUTPUT AND REVOLUTIONS
C-OUTPUT TO LAMPS AND REVOLUTIONS

FIG. 11.

USES OF INDUCTION GENERATOR.

The most probable use of the induction generator will be for boosting. Mr. Kelly has discovered (ELECTRICAL WORLD, March 20, 1897) that an induction generator, having its field coils in series with the mains, will act as a booster or feeder regulator, and that this action as a booster at any particular speed above synchronism will depend upon the amount of current supplied to the field magnets.

In order to use an induction generator as a booster the fields are connected in series with the main line, and the induction generator driven above synchronism. With no current flowing there will be no boosting action, but as soon as current flows the boosting action commences, its amount depending upon the current flowing in the mains, and this amount for a given current may be varied by varying the speed of the induction generator. So that

by the use of an induction generator as a booster, we get a machine with no brushes, collector rings or commutator.

In case the induction motor should ever be used for the propulsion of street cars, its action as an induction generator, when driven above synchronism, could be taken advantage of in descending grades, thus pumping back energy into the line, doing away with braking to a great extent.

TEST OF INDUCTION GENERATOR AS A BOOSTER.

The induction generator and alternator used in the above experiments were connected in series as single-phase machines, with a

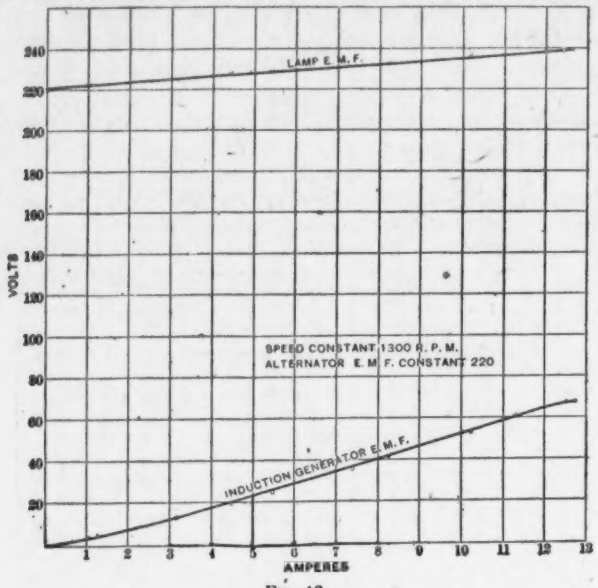



Fig. 12.

bank of lamps and readings taken to determine its boosting action.

In the first test as a booster the speed was maintained constant at 1300 revolutions per minute (synchronous speed 1230), and the current flowing in the mains varied from zero to the full load current of alternator, by adding lamps in lamp board. The results obtained are shown in Fig. 12.

In the second test the speed of the induction generator was va-

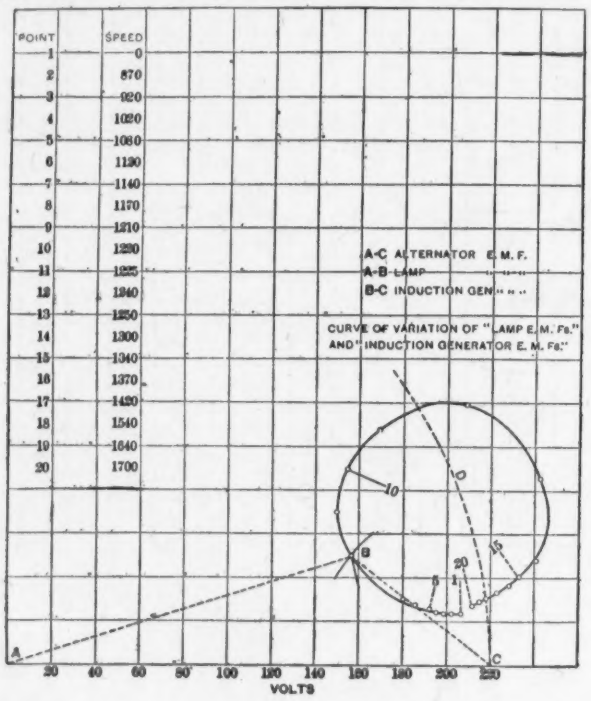



Fig. 15.

ried between wide limits, the alternator E. M. F. being maintained constant, and also the number of lamps connected in series with the two machines.

The results are shown in Figs. 13, 14 and 15.

In Fig. 13 the results show that the potential difference around the induction generator terminals increased from 28 volts at rest to 125 volts at a speed of 1235 revolutions per minute, and that a slight increase in speed caused the machine to supply e. m. f., in other words to act as a generator. This change, it will be noticed, is very sudden, going from a negative maximum to a positive maximum in about ten revolutions. Several attempts were made to get intermediate points between these two maxima, but without success.

Fig. 14 gives the curves of amperes and "lamp e. m. fs.," this last expression being the potential difference around the lamp terminals.

Fig. 15 shows the variation of the "lamp" and "induction generator e. m. fs.," polar co-ordinates being used. For all points within the dotted arc, *D*, the induction generator causes a drop in potential, and for all points without this arc the induction genera-

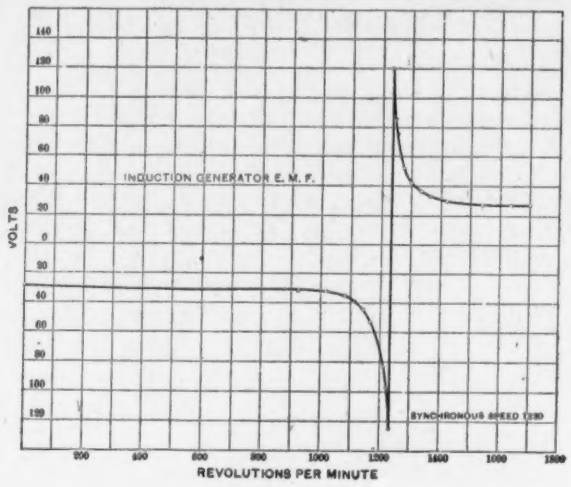



Fig 13

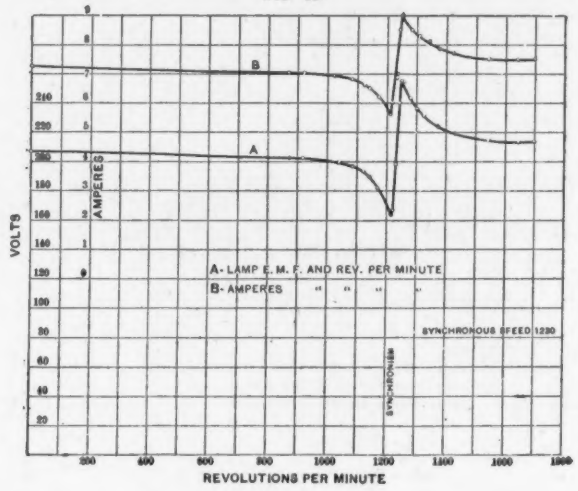



Fig 14

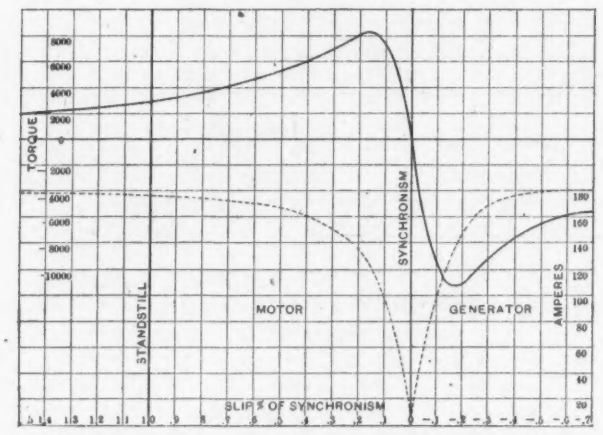



Fig. 16.—Induction Motor Speed Curves. $Z = 1 - 8j$ $Y = 01 + 1j$.

tor supplies potential to the system. The method of construction of this curve is simply the location of the vertices of the different triangles of e. m. fs. In this figure the points of the curve are numbered and the corresponding speed readings given in table.

It is interesting to note the similarity between the curves in Figs. 13 and 14 and the one for torque and slip, given in Fig. 16, taken from Mr. Steinmetz's paper on "Induction Motors." While the results, shown in these curves, were taken under somewhat different conditions, still the action, when the motor is driven near synchronism, is strikingly similar.

### The Death of Dr. John Hopkinson.

The announcement came from Berne, Switzerland, on August 29, that Dr. John Hopkinson, the well-known English electrical engineer, together with his son and two daughters, was killed while ascending one of the high Alps without a guide. It is reported that the unfortunate persons fell over a precipice to their death. The dispatch does not give the date of the occurrence of the sad accident, but it presumably happened within a day or two of the date of the Berne information.

Dr. John Hopkinson was the eldest son of Mr. Alderman Hopkinson, of Manchester, and was born in the year 1849. In the year 1870 he graduated as Doctor of Science in the University of London, and in the following year he graduated at Cambridge with honors rarely obtained by one man.

Early in the year 1872 Dr. Hopkinson accepted the appointment of engineer to Messrs. Chance Brothers & Company's lighthouse works, near Birmingham, at which town he lived until 1878, when he moved to London, and began practice as an engineer on his own account—without, however, giving up his connection with the firm, a connection which resulted in many improvements in lighthouse work; notably what is known as the group flashing apparatus. After his removal to London he became widely known as an expert in patent cases.

DR. JOHN HOPKINSON.

In the year 1877 Sir William Thomson communicated Dr. Hopkinson's first electrical paper to the Royal Society, and it was published in the "Philosophical Transactions." The paper dealt experimentally with the residual charge of the Leyden jar and the dielectric properties of different kinds of glass. In the course of this investigation he showed that the more highly conducting kinds of glass conduct electrolytically even at low temperatures. His next paper, published in the "Philosophical Transactions" of the same year, "On the Electrostatic Capacity of Glass," contained the results of an investigation carried out in order to test the truth of the conclusion deduced by Maxwell from his electromagnetic theory of light, that the product of the electrostatic capacity and the magnetic permeability of a transparent substance should be equal to the square of the refractive index for long waves.

During the years 1879 and 1880 Dr. Hopkinson read two papers of very exceptional importance, "On Electric Lighting," before the Institution of Mechanical Engineers. In the first of these he described a number of experiments made with a Siemens dynamo to determine its efficiency under varying conditions, and mapped out the relations between e. m. f. and current by means of curves, since called "characteristic curves." It was the nature of these curves which led the author to the discovery of the now well-known magnetic lag or hysteresis. Early in the year 1883 Dr. Hopkinson made some improvements in the Edison dynamo, which proved to be of exceptional importance in dynamo machinery. In the same year he was appointed to deliver before the Institution of Civil Engineers one of a series of lectures on "The Practical Applications of Electricity." His lecture was entitled "Some Points in Electric Lighting," and in addition to a most masterly general exposition of the subject he developed in it some very important points, such as the possibility of running two or more alternating machines in parallel. The theory of alternating dynamos was further developed in a paper on "The Theory of Alternating Currents," read before the Society of Telegraph Engineers in 1884.

Dr. Hopkinson received $90,000 from the Westinghouse Company, Ltd., for his British patents on the three-wire system of distribution, which he invented simultaneously with Edison in this country. These patents expired on July 27, 1896, a strong effort having been made to have them extended on the ground that special acts of Parliament had curtailed the life of the patents by six years. The application for extension was denied, however, on the ground that the benefits would be derived by the Westinghouse Company, and not by the inventor.

Dr. Hopkinson was elected as a Fellow of the Royal Society in 1878, and was also a member of the Senate of the London University. He was made president of the Institution of Electrical Engineers in 1890 and again in 1895. In his consulting engineering work he designed and superintended the construction of electric lighting installations in Manchester, Whitehaven and Stafford, and electric railway plants in Leeds and Liverpool. It is stated that Dr. Hopkinson had intended to sail for New York on September 28, on business in connection with a syndicate which was forming for the purpose of developing his inventions.

### Not All Engines Are American.

*To the Editor of The Electrical World:*

SIR—In a recent issue of one of your contemporaries there is a very chatty and interesting article on electric traction in Paris. The description of the plant and its accessories is brilliant and catchy, and gives the reader a pleasant impression of the truthfulness and accuracy both of the writer's kodak and powers of observation. The half-tone illustrations are also well executed, but a "dead give away" on the writer, for one of my engineering friends was nearly paralyzed on coming to the description, which states emphatically: "I refer to the engine room. Three high-speed Armington & Sims engines are at present in use, but two more are shortly to be added." On turning to the cut, one glance showed why the engineer so nearly fainted, for it shows clearly that the station is equipped with three Willans engines, built by Willans & Robinson, of Rugby, England. As soon as the engineer recovered his breath he gave vent to his feelings as follows:

"What in the name of fair play and square dealing caused a reputable paper to publish an article like that. Apparently it is intended to give interesting data, which the average reader will accept as facts, and it then deliberately gives an American engine company credit for supplying engines which were built by a well-known firm of English manufacturers. Is this another case of American brag run wild in claiming 'everything in sight,' or is it simply a case of another American abroad trying to do 'Europe in fifteen minutes,' or had the correspondent remained so long in France that he had forgotten to read plain English and so could not decipher the English name plate on an English-made engine, or still worse, has the lively correspondent become so wholly absorbed 'in the study of electrical matters that he has neglected to post himself on steam engine construction sufficiently to enable him to distinguish between an English vertical, triple-expansion, transfer, high-speed engine and an American horizontal high-speed engine?' The query is, which?

AN ENGLISH READER.

### An Odd Improvement in Telephone Repeaters.

In the specifications of patent No. 609,374, issued August 16 to J. S. Stone, of the American Bell Telephone Company, it is claimed that telephone repeaters consisting of a receiver actuating a microphonic transmitter work much better when inclosed in a vacuum. Under this circumstance, to quote the specification, "the messages automatically transferred from one circuit to another are reproduced in the receiving telephone of the second circuit with a well-defined gain in volume or loudness and without any substantial distortion or offsetting loss in clearness or articulation."

# DIGEST
OF
## CURRENT ELECTRICAL LITERATURE
AMERICAN AND FOREIGN
By Carl Hering

### Dynamos, Motors and Transformers.

EXCITATION FROM HALF THE DYNAMO VOLTAGE. Sengel. "Elek. Zeit.," August 11.—A reprint of the complete paper of which a brief abstract was noticed in the "Digest" July 16 (some statements in that abstract were not correct). If any one point of a continuous-current armature winding be connected to a slide ring contact, then between this third brush and either one of the others there will flow a current which is always in the same direction, but whose voltage varies between the total voltage of the machine and zero; it will thus be a pulsating direct current whose mean voltage is half that of the voltage between the two main brushes. He gives a curve of this current and discusses it analytically, showing that it may be assumed to be the sum of a continuous current and of an alternating current. A self-induction placed in this circuit would have no effect on the continuous current element, but would tend to choke off the alternating current element; the insertion of a self-induction in that circuit, therefore, will afford a means of obtaining a practically continuous current. He then describes some applications of such a system, which enables a current of half the voltage to be obtained from a dynamo. It may be used, for instance, for a three-wire system by connecting the neutral wire to this third brush through a choking coil. The pulsations might be completely neutralized independently of the choking action of a self-induction coil, if a second alternating current equal to the alternating element in the main current be added to the main current, but shifted through 180°; this may be accomplished by a second slide-ring contact connected to a diametrically opposite point of the winding; this resolves itself to the well-known system of Dobrowolsky, in which two opposite points of a winding are connected through a choking coil, the middle of which is then connected to the neutral wire. It may also be done by similarly connecting three symmetrical points to the common point through choking coils, and this will give three alternating currents, differing by 120°. The system suggested by Ettingshausen is also quite similar to this one; in it there are two auxiliary windings connected to two diametrically opposite points of the armature, and thence to a slide ring on which the third brush rests; each of these windings embraces half the armature and half the number of windings as compared with the similar part of the main winding; the present author shows that a single auxiliary winding would accomplish the same purpose. A useful application of this method of obtaining half the voltage of the machine is to excite the shunt field between this brush and one of the others; it has the advantage that the wire of the magnet coil then has double the cross-section, and this is of importance with shunt machines for high voltages, especially for smaller machines; it diminishes the cost of material and construction of the field windings and utilizes the coil space to greater advantage. In the same way the system can be used to advantage for shunt motors; here it has the additional advantage that in starting the motor there will be the full voltage at the terminals of the field magnet, which means double the normal excitation, thus increasing greatly the starting torque; the voltage at the terminals of the field will vary from the full voltage to half of this as the normal speed is reached; the regulation from the double excitation to the normal is thus accomplished quite automatically without the need of resistances; moreover, this current also flows through more or less of the armature, and thus increases the armature current. Tests made confirmed the theories; a more detailed discussion is promised. The question arises whether the pulsating currents will be sufficiently dampened by the self-induction of the shunt field coil, so that there will be no appreciable variation in the magnetism, which involves losses in the iron. A test showed that about 5 per cent. of the energy was lost in this way; this loss will increase with the frequency.

ELECTRIC GENERATORS. Parshall and Hobart. Lond. "Engineering," August 12.—In this continuation of their long serial they describe the calculation of the magnetic circuit of a dynamo; this is shown very briefly by an example of a simple case; they prefer to calculate the ampere turns separately for each portion of the whole magnetic circuit and add these together, instead of making the laborious calculation of finding the total reluctance of the magnetic circuit. For field magnet windings the following formula is said to be of great service: The number of pounds of copper per spool is equal to 31 divided by the watts consumed in the coil at 20° C., this fraction being multiplied by the square of one-thousandth of the number of ampere feet; the latter term is equal to the number of ampere turns multiplied by the mean length of one turn, in feet; a foot note describes how this formula is deduced; an example is also worked out. A full page of illustrations is also given, showing experimentally determined, no no-load saturation curves for several different types of machines, together with sufficient of the leading dimensions to enable the results to be profitably studied and compared.

THREE-PHASE MOTORS WITH SHORT-CIRCUITED ARMATURE. Niethammer. "Elek. Zeit.," August 11.—An illustrated description of the Boucherot system referred to in the "Digest" February 19, 26, April 16, June 11, 18.

ROTARY TRANSFORMERS. Marchena. "L'Ind. Elec.," August 10.—The first part of an article in which he intends to discuss in as simple a manner as possible and without involved mathematics the properties of rotary converters with special reference to electric traction. The present portion is introductory, comparing the relative advantages of three-phase transmission direct to the cars for long-distance lines, and the system in which the three-phase current is transformed at substations into continuous current; he shows that the advantages are in favor of the latter method, the former being of advantage only on long lines carrying light trains at frequent intervals, when the power house can be a single station at which the energy is developed cheaply—that is, if the question of efficiency is not important, but where the attendance is to be minimized; but in nearly all other cases it will be more advantageous to use the second method—that is, to transmit the energy in the form of three-phase current and use it as continuous current. In this system the present tendency is to use rotary converters combined with static transformers, as distinguished from a synchronous motor coupled to a generator; it reduces the cost of the sub-station and the efficiency is higher, while the cost of operation is lower.

MAGNETIC LEAKAGE IN TRANSFORMERS. Kapp. "L'Ind. Elec.," August 10.—A long abstract of the article noticed in the "Digest" May 7.

TRANSFORMER PATENT.—Lond. "Elec. Eng.," August 12.—A reprint in full of the Zipernowski-Deri British patent, which is claimed to be the fundamental transformer patent and is about to be used to extract royalties from those using transformers in England.

### Lights and Lighting.

ILLUMINATION OF INTERIORS. Thompson. "Zeit. f. Beleucht.," August 10.—An article somewhat similar to the one by the same author noticed in the "Digest" May 28; it contains more curves. He gives the results of measurements made of the illumination in a closed room with different kinds of shades around the incandescent lamps; the results are given in curves, together with the theoretical curve. He seems to have obtained good results with the inverted conical shades, reflecting the light onto a white ceiling; these shades should intercept all direct light from the filament; the less the difference in the illumination of the different parts of the room, the more agreeable was the illumination; the light through ground glass is not as pleasant as through opal glass; large spherical globes completely inclosing the lamp gave very good results, and admit of artistic effects. The best distribution was obtained with the inverted conical shades of an angle of 90° and made of frosted glass in preference to opal glass. A light of 16 candle power, which can be raised or lowered, is quite sufficient to light a table with 2.6-feet candles and the room with 0.5-feet candles, if a spherical frosted glass shade is used; ground glass pear-shaped globes give much light, but are too intense—the diffusion is not sufficient.

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ECONOMICAL CARBONING OF ARC LAMPS. Clarke. "Elec. Eng.," August 25.—A note stating that lamps may be so carboned that a double lamp will run two nights of fourteen hours each, thus reducing the number of trimmers to one-half; he claims that for some unaccountable reason few lighting stations are aware of this fact. It is accomplished by using five-eighths-inch plain carbons in the upper holders and half-inch copper-coated carbons in the lower, and then reducing the current from 9.5 to 9 amperes. It will necessitate slight alterations in the adjustments of the lamps.

WELSBACH LAMP FILAMENT.—"Elec. Eng.," August 25.—A brief account of the osmium filament invented by Welsbach, descriptions of which were noticed in the "Digest" some months ago.

### Power.

SINGLE-PHASE MOTOR PLANT. Geist. "Elek. Zeit.," August 11.—A short article describing the plant at the wharves at Cologne. All the trains, lifts, etc., in the municipal docks are run with hydraulic power, the water for which is pumped by means of single-phase motors of 70 horse-power, the power for which is obtained from the central lighting station in the form of a 2000-volt single-phase alternating current; this is transformed down to 220 volts, at which it is used in the motors. The 70-hp motors consist of a chief motor and a starting motor on the same shaft, besides which there is also a fast and loose pulley; the starting motor is wound as a two-phase motor and appears to develop about 4 horse-power, which brings the main motor up to speed in about two minutes; its armature is short-circuited and the motor is on the end of the shaft which projects beyond the bearing. Only a single switch is necessary for the large motor; its armature is also

short-circuited; at its best power—namely, 50 horse-power—it has an efficiency of 87 per cent. The method of operation is described; the pumps are driven through a countershaft; the motor is started without load; the action is automatic, the motors being regulated by a device operated by the hydraulic accumulators; the power is applied gradually, and produces no objectionable effects on the central station net work. He thinks there is no question that there is economy in thus obtaining the power from a large central station.

MACHINE TOOLS.—"L'Ind. Elec.," August 10.—A short, illustrated description of several direct-driven machine tools, as used in the Siemens & Halske factory.

SMALL INDIVIDUAL MOTORS.—"Elec. Eng.," August 25.—A short article describing briefly the application of very small motors in a factory where telephone coils are wound; the installation is of interest on account of the fineness of the sub-division of the power. Each operator has a small motor and the coil to be wound is placed directly on the shaft; the operators can be placed where light is good instead of having the place selected in reference to the shafting; the speed is more perfectly under control and consequently better work can be done.

NIAGARA POWER.—"West Elec.," August 20, and "Elec. Eng.," August 25.—A short note on recent progress at this station, the first named journal containing a number of illustrations.

## Traction.

CONTACT BAR. Stobrawa. "L'Elec.," August 13.—A French translation, with the illustrations, of the article noticed in the "Digest" June 12; see also July 30.

MIDDLESBROUGH.—Lond. "Elec. Rev.," August 12.—A well-illustrated description of the electric railway plant extending to Stockton and Thornaby. (See also THE ELECTRICAL WORLD of August 6, page 137, for a full, illustrated description of this plant.)

CORK. Griffin. Lond. "Elec. Eng.," August 12.—A reprint of a recent paper giving an illustrated description of the railways.

HIGH-SPEED MAIL SERVICE.—"Elec. Eng.," August 25.—A brief description of the McGurty electric mail and express railroad system, of which a series of tests were made at Jersey City Heights during the past three weeks on a model circular track 0.25 miles in length. There is to be no attendant on the car, the control being automatic and from the stations. It is proposed to run 120 miles per hour, but in the model the speed attained was only 18 miles per hour; the car is intended to be 30 feet in length and have a capacity of 40,000 pounds; it appears that alternating-current motors are to be used.

ACCUMULATOR TRACTION IN PARIS.—"Sc. Am. Sup.," August 20.—A translation of a short, illustrated article from "La Nature," describing the combined trolley and accumulator line in Paris.

RAILWAY LINES AND RETURNS. Pepper. "El'ty," August 24.—A reprint of the paper noticed in the "Digest" July 23.

## Installations, Systems and Appliances.

THREE-PHASE EXTENSIONS OF CONTINUOUS-CURRENT PLANTS.—Lond. "Elec.," August 12.—A note stating that at Manchester the system advocated by Wordingham is about to be tried on a small scale. Some of the outlying districts of the present continuous current station are to be supplied with low-pressure continuous current for distribution on a three-wire system at 400 volts between the outers; the continuous current from the central station bus bars will be transformed by rotary and stationary transformers into a 5000-volt three-phase current, which will be converted back to a low-pressure continuous current at the sub-stations; the present extension is for 600 kilowatts.

DISTRIBUTION FROM CENTRAL STATIONS.—"West. Elec.," August 20.—A reprint in full of the discussion of Wagner's and Ferguson's papers read before the National Electric Light Association in June.

DAY LOAD. Economy. "Can. Elec. News," August.—A short article, in which he advocates a combination with the city water works, so that the spare power during the day could be used for pumping water.

## Wires, Wiring and Conduits.

RULES AND REGULATIONS FOR HIGH-PRESSURE INSTALLATIONS.—Lond. "Elec.," August 12.—A reprint in abstract of the German rules noticed in the "Digest" August 20. (In that abstract the word "insulators" should read "installations.") In an editorial some criticisms are made; the rules allow the frames of generators to be insulated from the earth if precautions to insulate the attendant are also taken; this is not approved editorially, and it is thought that it would involve very little hardship if it were required that the frames of all machines and transformers should be earthed; another rule goes to the other extreme and requires that unless the floor in front of the switchboard is uninsulated the switch itself must earth the outside circuit on its disconnection. To specify that all overhead wires are to be bare is a new departure, but is probably intended to do away with any false sense of security given with the light insulated covering often used on such wires, especially in America. Regarding the conventional symbols hope is expressed that they will be ignored in favor of those now in use.

INSULATOR.—Lond. "Elec. Eng.," August 12.—An answer to a request to describe an insulator for out-door use which will stand a pressure of 2000 volts and carry 50 pounds.

INSULATED WIRE SPECIFICATIONS.—"Ind. Rub. World," August 1.—A reprint of the general specifications issued by the United States Navy and in force since March, 1897, for all classes of insulated wire required for the ships of the navy.

WIRING OFFICE BUILDINGS.—"Can. Elec. News," August.—An illustrated description of a system devised by Strickland by means of which a suite of offices can be interchanged from one meter to separate meters, or the reverse.

ALUMINUM VS. COPPER AND BRASS FOR ELECTRICAL CONDUCTORS. Hunt. "Sc. Am. Sup.," August 20; reprinted from the "Aluminum World."—An article pointing out the advantages of aluminum as compared with brass and copper, for conductors.

## Electro-Physics and Magnetism.

EFFECT OF TEMPERATURE ON THE RESISTANCE OF STEEL. Chatelier. "L'Ind. Elec.," August 10.—An Academy paper giving the results of investigations of the effect of temperature on the electric resistance of steels. The effects of the temperature of the tempering process are shown by a table of figures; when the temperature of the tempering was 950° C. the resistance was tripled; 750° C. is the temperature at which tool steels are usually tempered. The results show that the tempering alters the resistance only if the temperature has exceeded that of recalescence, namely 710° C.; this temperature is that which is required to change the mechanical properties; the resistance then increases with the temperature of the tempering to a value which is higher the richer the steel is in carbon; the increase of specific resistance in iron due to the presence of carbon is about 45 microhms-cm for 1 per cent. of carbon, or 7 microhms-cm for 1 atom in 100; this is the same increase which he noticed previously for silicon. The effect of the presence of other bodies than carbon was then investigated, notably tungsten and chromium; their effects are quite different, for at high temperatures chromium increases the rate of increase of resistance due to the tempering of carbon steels, while tungsten diminishes this; this leads him to believe that chromium, after the tempering, remains, in part at least, as a mixture like nickel or manganese, while tungsten remains isolated in the mass of iron.

LONGEST HEAT RAYS. Rubens and Aschkinass. "Wied. Ann.," No. 6; abstracted in the Lond. "Elec.," August 12.—They entered a step further into the region where the spectrum joins the Hertzian wave system and attained a wave length of 0.067 mm, which is 100 times the wave length of red light and 60 or 70 times smaller than the smallest electromagnetic waves yet produced—namely, 4 mm; the gap between these, therefore, remains to be bridged. The property of these long heat rays is more closely akin to those of electromagnetic waves than to waves of light.

POLARIZED ELECTROMAGNETIC WAVES. Latrille. "Wied. Ann.," No. 6; abstracted in Lond. "Elec.," August 12.—He considers an analogy between the electromagnetic and light waves in the transmission through slits. A slit exerts a polarizing action on the electromagnetic wave and transmits most easily the component perpendicular to itself; more energy is transmitted as the slit is increased in length, but not in proportion to the length; when the width is increased from 5 mm upward the energy increases slowly at first and then more rapidly up to a certain limit. A coherer responds more readily to vibrations parallel to its axis than to those perpendicular to it.

THEORY OF THE ETHER. Larmor. "Proc. Roy. Soc.," No. 398; abstracted briefly in the Lond. "Elec.," August 12.—An article in the form of a supplement to his third memoir on the electrical theory of the ether, in which he deals with the a priori difficulties encountered in the conception of orbital systems of electrons moving through a practically stagnant ether.

RADIOGRAPH TUBES. Bonetti. "L'Ind. Elec.," August 10.—A very short Academy note. By varying the state of the gas in the interior of the bulb he succeeded in obtaining a lower resistance and thereby was enabled to use tubes which had become "hard" and were no longer of use. The method he used was to maintain a platinum wire at a red heat inside of the tube; the current was 2 to 3 amperes at 4 volts, and with this he obtained excellent results.

X-RAYS. Kalischer. "Elek. Zeit.," June 30, July 7 and 14, August 4 and 11.—The continuation and conclusion of his long series (see "Digest" July 9).

TANGENTIAL SCREENING. Du Bois. "Wied. Ann.," No. 6; abstracted from the Lond. "Elec.," August 12.—He discusses the possible type of screening action in which the lines of force are parallel to the surface of the screen, as distinguished from the case previously considered, in which they are perpendicular to the screen. The simplest case is that of a straight wire carrying a current and surrounded by an iron tube. He uses the toroid of revolution as the typical body. If such a screening action existed a perpetual-motion machine might theoretically be constructed by introducing the pole of an infinitely thin magnet into the magnetized toroid through the narrow, equatorial section, where it would revolve in a circle forever.

TERRESTRIAL MAGNETISM IN AUSTRIA. Trabert. "Zeit. f. Elek.," August 7.—A review and discussion of the report

of Lizner on the new observations of the earth's magnetism in Austria-Hungary, under the auspices of the Imperial Academy of Science, which supplied the funds.

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HYDRAULIC ILLUSTRATION OF WHEATSTONE BRIDGE. Hallock. "Science," August 19.—An illustrated description of a hydraulic analogy to illustrate the action of the bridge. The resistances are introduced in the form of clamps around a rubber hose; a capacity is represented by an aspirator bottle connected to the tubes; a self-induction, by coiled rubber tube; the galvanometer, by two vertical parallel manometer tubes; the apparatus is horizontal and a stream of water passes through it.

RADIOGRAPHIC APPARATUS.—"Sc. Am. Sup.," August 20.—A reprint from a German paper of an article giving an illustrated description of some improved apparatus made in Germany.

### Electro-Chemistry and Batteries.

CALCIUM. Moissan. "L'Ind. Elec.," August 10.—An abstract of an Academy note in which he shows that metallic calcium may be obtained in the form of crystals or melted globules by electrolyzing fused iodide of calcium at a dull red heat; this salt conducts quite well at that temperature. The negative electrode is pure nickel, while the positive consists of a cylinder of graphite in the centre of a porous cup; the temperature is maintained by the current at about the fusion point of this salt.

ELECTROLYSIS OF ZINC SOLUTIONS. E. A. "L'Elec.," August 13.—An abstract and discussion of a long paper by Ashcroft read before the English Society of Mining and Metallurgy, describing his extended experience with his process on a large scale for a number of months, at the Broken Hill mines in Australia. This process was finally abandoned.

ACCUMULATOR CONSTRUCTION. FitzGerald. Lond. "Elec. Eng.," July 22 and August 12.—In this continuation of his long serial he continues the discussion of the cell mentioned in the last section (see "Digest" August 6), which, in some respects, is a new departure and some of the details of which are still kept secret. He then contrasts some striking points of the traction cell recently described and some English cells, with special reference to the weight of the electrolyte. He holds that a density of 1.264 is perfectly safe in the case of a traction battery, but that a lower density is preferable for a battery which remains at rest for comparatively long periods; by using less acid at a greater density there will be an enormous reduction in weight of the transportable battery, and this saving in weight is much more important than the conductivity of the electrolyte. He then discusses the calculation of the bulk of a cell of a given capacity.

ELECTROLYTIC THEORIES. Edser. Lond. "Elec. Eng.," August 12.—In this continuation of his serial he discusses reversible cells.

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STORAGE BATTERY DEVELOPMENT AND APPLICATIONS. Appleton. "Proc. Eng. Club" of Philadelphia; a long abstract is given in the "Elec. Rev.," August 24.—A paper read before that society; it is general in character, describing briefly recent large plants installed by a certain company and pointing out briefly the advantages of an auxiliary accumulator plant under various circumstances. The main portion of the paper refers to electric vehicles. The paper is descriptive in character, and contains very little data.

UTILITY OF PRIMARY BATTERIES.—"Elec. Rev.," August 24.—A reprint of the editorial noticed in the "Digest" last week.

CARBORUNDUM.—"Amer. Mach.," August 11.—An illustrated description of the method of manufacturing this material.

TREATMENT OF ORES CONTAINING PRECIOUS METALS. Webber. "El'ty," August 24.—The beginning of a reprint of the paper noticed in the "Digest" February 19, 26, March 5, 12, 19, April 9.

### Units, Measurements and Instruments.

SUBMARINE CABLE TESTS. Murphy. Lond. "Elec.," August 12.—An article on the interpretation and correction for leakage of conductor resistance tests of submarine cables. He shows that the normal observed conductor resistance of even a perfect cable may differ materially from the true resistance, and that the conductor resistances cannot be properly compared until they have been corrected for leakage as well as temperature. He deduces some simple rules and formulas, which have been in use for a number of years with most satisfactory results and have proved sufficiently accurate for practical purposes. The rules are as follows: 1. The "fall" in conductor resistance due to a leak is directly proportional to the square of the conductor resistance beyond the apparent position of the leak, and inversely proportional to its apparent resistance. 2. The apparent distance of the leak from the observer is equal to the square root of the product of the fall observed by the distant station and the apparent resistance of the leak observed by himself. 3. The dielectric resistance of the cable is equal to the square of the conductor resistance beyond the leak divided by the observed fall. 4. The resultant leak is distant from each and inversely as the square root of the falls.

PRIMARY BATTERY TESTS.—Lond. "Elec. Eng.," August 12.—A reply to a request to state what tests should be made to determine the value of a primary battery for lighting purposes.

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VALUE OF A RESISTANCE. Ayrton. "Sc. Am. Sup.," August 27.—A reprint of his article noticed in the "Digest" December 18, 1897, on "Our Knowledge of the Value of a Resistance."

ELECTRICAL RESISTANCES. Atkinson. "El'ty," August 24.—The beginning of a reprint of the paper noticed in the "Digest" May 14; see also May 28.

### Telegraphy, Telephony and Signals.

TELEPHONE DISTRIBUTING SYSTEMS. Baumann. "Elek. Zeit.," August 4 and 11.—A long article in which he calls attention to the insignificantly small number of connections which a subscriber makes, as compared with the possible number of connections which he could make with all the other subscribers, and he then shows how greatly the work at the central station may be diminished by various modifications in the distributing system of wires. There are, for instance, many cases in which two subscribers have very frequent communication with each other, and if this were accomplished by direct wires connecting them it would save the central station all those calls; moreover there are many local groups of subscribers who hold many of their communications between each other; these might be directly connected each with the other, and besides have facilities for connecting to a common wire station; in some cases it would suffice to connect only one of two subscribers to the central and have a separate connection from that subscriber to the other; moreover a number of the groups might be connected with each other directly; some subscribers would rarely, if ever, have any need of being connected with the central station; a subscriber might also be connected directly with a number of these groups. A number of such groupings are discussed and illustrated. With such modifications as these the construction and operation of the central station would become very much simpler and cheaper.

AUTOMATIC EXCHANGE SYSTEM.—Lond. "Elec.," August 12.—A brief, illustrated description of a modification in the form of an extension of the system referred to in the "Digest" June 4, so that it will now accommodate up to 10,000 subscribers; it is provided with what is termed the bridging system.

HERTZIAN TELEGRAPHY.—Lond. "Elec. Rev.," August 12; reprinted without the illustrations in "El'ty," N. Y., August 24.—A well-illustrated description of the Ducretet apparatus recently described before the International Society at Paris and referred to in the "Digest" June 25 and July 9.

HERTZIAN WAVE TELEGRAPHY.—Lond. "Elec. Rev.," August 12.—A reprint in abstract of the English Lodge and Muirhead patent, No. 18,644, 1897.

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TIMING TELEPHONE CALLS. Abbott. "Elec. Eng.," August 25.—A long article discussing the relative merits of the different methods and appliances used in the United States; these are divided under six heads, the one which he appears to consider the best being the calculagraph system, to which the greater part of the article is devoted. The calculagraph is an instrument which makes a printed record of the time elapsed, mechanically subtracting the time of connection from the time of disconnection, and printing the result on a ticket; the operator has merely to pull a lever at the start and the finish. He points out the advantages of this instrument; it is in use at a number of exchanges and is admitted to be a decided improvement; it is accompanied by a reform in the operating methods, and this is its chief element of value; it has been introduced quite generally into the exchanges of the Bell companies in the past two years.

PARTY TELEPHONE LINES. Miller. "Elec. Eng'ing," August.—The beginning of an illustrated article on the general subject of party lines—that is, those running to more than one subscriber; the various systems are classified, described and discussed.

TELEPHONY IN SWEDEN.—"West. Elec.," August 20.—A note, with some illustrations, showing the systems of ducts used by the Stockholm Company, which is rebuilding its system and consolidating three exchanges into one.

EFFECT OF TELEGRAPHIC WORK ON HEALTH.—"Elec. Rev.," August 24; reprinted from the Lond. "Lancet."—An abstract of a paper by Hull, giving an unfavorable account of the effect of telegraphic work on the health of the operators; he thinks this work is responsible for many bodily ailments. The prevalence of phthisis among telegraphers is shown in a table by Garland, which was given as evidence before a royal commission; it shows the comparative percentage of mortality from respiratory diseases; the average for all adult males, deaths after fifty-five years not included, is 24.4; for telegraphers, 59.5; and for cutlery grinders, 57.3.

RELAY RESISTANCE. Hewett. "Teleg. Age," August 16.—A discussion of the question of the relay resistance, the energy expended and the static condition of the line. He concludes that in order to improve the working efficiency of a heavily loaded line more energy must be expended where it will do most good, and that place is in the line; with high resistance relays the expenditure of additional energy will usually make the matter worse.

MANILA CABLE.—"West. Elec.," August 20.—A chart and a table of distances of the system of cables connecting Hong Kong and Washington.

BLOCK SYSTEM. Hope. "Teleg. Age," August 16.—A brief, general review of the block system as applied to railroads.

## Miscellaneous.

PARIS EXPOSITION.—"L'Ind. Elec.," August 10.—A reprint of the official documents concerning the conditions governing the installation and operation of electrical exhibits at that exhibition. Editorially, attention is called to the limitations of the voltage and frequency; if the installation is complete in itself—that is, includes all the wiring and receptive devices—then no limit is placed on the voltage or frequency. The administration contributes but little toward the expenses of the installations; a group for 1500 horse-power, for instance, will receive $1,800, which is about one-tenth of the cost of the installation; the proportion is about the same for the cost of operation.

RESISTANCE OF THE HUMAN BODY. Dubois. Lond. "Elec. Eng.," August 12; reprinted in "El'ty," N. Y., August 24.—An abstract of his recent French Academy paper, referred to in the "Digest" August 20. He described experiments on the duration of the variable period of current flow when the difference of potential is applied to the human body. He concludes that during the period of variable current the body presents a reactance much smaller than the ohmic resistance; its capacity partially annuls the resistance; the resistance, however, during the variable period of the current is constant; it increases with the length of the parts of the body in circuit and depends on the surface of the electrodes; the body acts as a condenser with a liquid dielectric having a capacity equal to about 0.165 microfarads.

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SMALL ELECTRIC FURNACE. Hopkins. "Sc. Am. Sup.," August 27.—A well-illustrated description of a small laboratory furnace adapted to be connected to a 110-volt circuit; he gives detailed instructions for the production of calcium carbide and other directions for the construction and operation of such a furnace. One of the main features is that three arcs are used in series in the same furnace, there being three carbons opposite three others, and by this means only a short length of resistance wire is required. Very successful results were obtained with this furnace, and many metallurgical processes were carried on. A 12-ampere fuse in each leg of the current is sufficient; the carbon electrodes may be separated 3.5 inches without extinguishing the triple arc. It appears that the furnace is easily constructed.

CONVENTIONAL DIAGRAMS. Van Orden. "Teleg. Age," August 16.—A short discussion of the diagrams suggested by the Chicago Elec. Assn. as far as they apply to telegraphy. He does not favor them, claiming that they are too simple and depend upon a key for their interpretation, therefore failing of their purpose. He reproduces what he calls the old methods in a parallel column (these, however, require a comparatively large amount of draughting).

"ELECTRICAL ENGINEERING."—This journal, published in Chicago, has changed hands, and is now called "Electrical Engineering and Telephone Magazine." It is published on the 15th day of every month. Its policy has been radically changed, as one of the principal objects will be to give, in an impartial and unbiased manner, accurate information of the progress made in the independent telephone field throughout the United States. The new editor is C. E. Kammeyer.

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## A Line of Presses for the Manufacture of Armature Discs.

The requirements of armature work for electric motors and dynamos have led to the construction of presses which differ in essential points from those used for other styles of sheet metal work, and the representative group of such presses, built by the E. W. Bliss Company, 12 Adams Street, Brooklyn, N. Y., shown below, is of particular interest as embodying the types of many of the machines used in the manufacture of armature discs.

The press shown in Fig. 1 is specially designed for simultaneously cutting the inside and outside of plain rings, with or without key notches, such as is shown on the floor in the illustration. It will do work of this class up to 21 inches in diameter. The rings or discs as they come from this press are ready for notching by means of the machine shown in Fig. 3. The press may be also used for simultaneously punching the notches on discs up to 10 inches outside diameter or more, if the developed cutting edge does not become too great. The press is supplied with an automatic knockout.

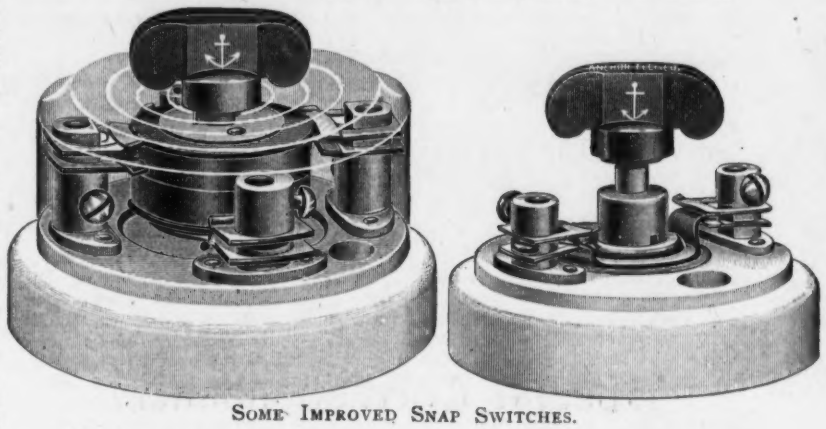
The "Stiles" double-crank power press, Fig. 2, is extensively used in the manufacture of armature sections, and embodies a number of special features which have not heretofore been used in connection with presses of this class. It is made in a number of sizes weighing from 1600 to 25,000 pounds. It is sometimes supplied with a positive knockout for punch and die, making the press specially adapted for cutting the entire armature disc (outside, inside and notches) in one blow, and for that class of work is employed on discs up to 11 or 12 inches in diameter. Beyond that size it is usually furnished with back gearing and sometimes with a body of cast steel instead of cast iron. It may, however, also be used for plain rings, and in that case is designed to take in up to 24 inches diameter. It is also a useful machine for cutting the smaller sections for armatures for large generators, in which case the outside of the sections and holes in same are mostly punched in one operation.

The "Bliss" automatic notching press is illustrated in Fig 3. This machine is of entirely new design, and offers several important advantages over other machines of this class. It is made in three sizes, with or without clamping arm, weighing from 1500 to 3000 pounds, and is adapted for automatically notching with great accuracy discs of from 3 to 60 inches in diameter.

The shear shown in Fig. 4 is specially designed for cutting the inside and outside of armature discs. It is very carefully built throughout, so as to meet the demand for a tool of greater accuracy and strength than the ordinary cheaply built shears in the market. The angular position of the lower cutter permits of making as clean a cut on the inside as on the outside of the discs. It will cut circles up to 60 or 72 inches in diameter.

The "Stiles" power punching press is also much used for electrical work, being adapted for nearly every kind of blank cutting, punching, perforating, forming, bending, etc.

If a more detailed description is wanted of any of these machines the Bliss Company will take pleasure in giving any further information that may be required. This company has had almost unlimited experience in the manufacture of tools for producing armature discs and other sheet-metal electrical parts and fittings, and will be pleased to correspond with any one interested.



SOME IMPROVED SNAP SWITCHES.

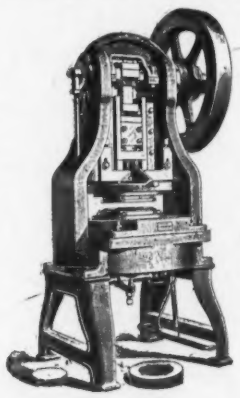


FIG. 1.

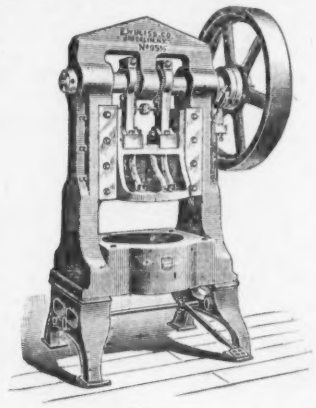


FIG. 2.

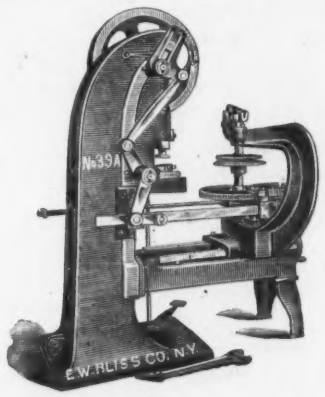



FIG. 3.

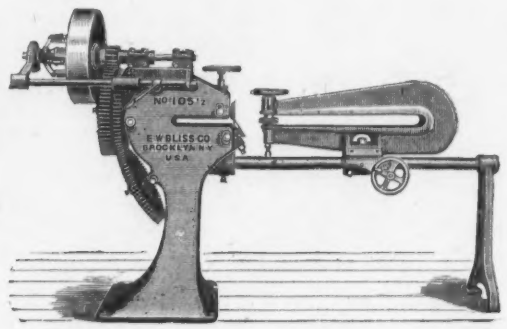



FIG 4.

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## Improved Snap Switches.

The new designs of Anchor snap switches, one size of which is illustrated in the cuts shown above, and which are being manufactured by the Anchor Electric Company, of Boston, possess several noticeable improvements in this class of circuit breakers.

The covers are completely insulated on the inside by heavy bristol board, which extends below the edge, preventing the possibility of arcs or short circuits through the cover. Another common difficulty, the stripping of threads in the binding posts, is overcome by drilling the wire holes eccentrically, which gives abundant threads for the binding screws.

In the single-pole switch the spring is covered with a dome, which, at the same time, serves as a long bearing on the spindle for the moving contact. In the double-pole switch, the insulating separator, composed of a new heat-resisting and strong material, completely envelops the moving contacts (which are loose and move to accommodate themselves to the knife contacts on the binding posts), preventing all chance for the arc following along the edge, a fault common in many styles of snap switches. Long life in the mechanism is insured by constructing all the working and non-current-carrying parts of nickeled steel. These switches have been approved by the National Board of Fire Underwriters, after exhaustive tests.

# NEWS OF THE WEEK

## Financial Intelligence.

THE METROPOLITAN STREET RAILWAY COMPANY, of New York, has declared a dividend of 1¼ per cent. on the present capital stock, payable October 25.

OPPOSITION TO THE GENERAL ELECTRIC CAPITAL REDUCTION.—The owners of about 10,000 shares of the preferred stock of the General Electric Company have taken steps to prevent if possible the carrying out of the plans recently approved by the joint action of the preferred and common stockholders to cut down the capitalization. It is claimed that this is a direct spoliation of the interests of the preferred stockholders in favor of the interests of the common stockholders. The next step in the proceedings will be the filing of the answer to the bill brought by counsel for the committee, after which the court will set a date for a hearing, probably in November.

BROOKLYN RAPID TRANSIT.—It has been announced that this company has total fixed charges to the amount of $2,045,000 annually. For the year ending June 30, 1898, during which time it had been operating over the Brooklyn Bridge but four months, the company earned over and above the operating expenses $2,112,500, or $67,000 more than the present fixed charges. Since the end of the fiscal year the increases are stated to have averaged from $2500 to $3000 per day gross. Estimating an average daily gross increase for the year of $1500, of which two-thirds may be assumed to be net, this would give a net return of something over $430,000 for Brooklyn Rapid Transit stock, which would be equal to a little over 2 per cent. on the par valuation.

## Special Correspondence.

### NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
9 Murray St., NEW YORK, August 23, 1898.

THE KINGSBRIDGE EXTENSION.—The ditch excavated in the Kingsbridge road on the upper part of Manhattan Island in December, 1896, for the construction of a street railroad is at last to be filled in. Judge McAdam has directed the commissioner of highways to commence work within thirty days. The trench was excavated by the Third Avenue Railroad Company, but the franchise was objected to by the Metropolitan Street Railway Company, and litigation has been carried on in the courts ever since. Abutting property owners have attempted again and again to get the matter settled, but hitherto without success.

THE SECOND ANNUAL OUTING of the employees of the Conduit Wiring Company, New York, Davis & Brussel, successors, was held August 21 at Donnelly's Grove, College Point, L. I. A most enjoyable day was spent in bowling, land and water races, etc. Among the visitors were Messrs. Olson and Harrington, of the Habirshaw Wire Company; Mr. Scribner, of the Bryant Electric Company; Mr. Kirkland, of the American Circular Loom Company, in addition to representatives of most of the large supply houses in New York. Mr. Davis, of the firm, was also present, and took an active interest in the games and other diversions. Messrs. Fenton, Koehler and Bennett were the committee in charge of the affair.

### NEW ENGLAND NOTE.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, Mass., August 26, 1898.

THE TUNNEL TO EAST BOSTON.—The Boston Transit Commissioners gave a public hearing on August 23 on the question of routes for a tunnel or tunnels to East Boston. The appropriations which have been made for this purpose are insufficient to construct a tunnel connected with the subway, as many had hoped could be done, and are barely sufficient to run from Maverick Square, East Boston, to a point as near the water front on the Boston side as the grade will permit.

### PHILADELPHIA NOTE.

Branch Office of THE ELECTRICAL WORLD,
929 Chestnut Street,
PHILADELPHIA, Pa., August 24, 1898.

STOCK INCREASE OF THE TELEPHONE COMPANY.—A meeting of the stockholders ot the Bell Telephone Company, of this city, will be held on September 24 to vote on the question of increasing the capital stock from $2,000,000 to $4,000,000.

### BUFFALO AND NIAGARA FALLS NOTES.

BUFFALO, N. Y., August 26, 1898.

A CARLOAD OF TRANSFORMER MACHINERY for the city lighting plant has been received, and as soon as the switchboards are here the work of fitting up the station will begin in earnest. About a carload a week is promised until the apparatus is all here.

THE UNDERGROUND ELECTRIC CABLES in Buffalo, all of which are branches of the great tunnel cables or a part of the primary line, are to be considerably extended. About a dozen firms of cable manufacturers have been asked to bid on the furnishing of the cables, which will cost from $25,000 to $30,000 before they are laid.

A MONSTER TRAVELING CRANE for carrying steel vessel plates from the forge to the dock is now in service in the yard of the Union Dry Dock Company. It is operated by Westinghouse type C induction motors. The use of electricity in the plant is to be extended further by the substitution of electrically driven pumps for the present steam pumps, for discharging the docks.

A BALL-BEARING RUNNING GEAR for street cars has been invented by Harvey Hoag, of Buffalo, who has interested the Buffalo company so much in its merits that a car on one of the lines has been equipped with it, and is running apparently with entire success. There are forty-six half-inch balls used to the bearing. The inventor claims that more than half the power is saved by the invention, and that it requires next to no oil.

THE BUFFALO GENERAL ELECTRIC COMPANY has under consideration the adoption of the Thomson recording two-rate wattmeter, one of which has been received and is undergoing test. By means of this meter it will be possible to give a cheaper rate to customers who use electricity, but who can take it at off hours of the day. The great demand for lights is from 4 to 9 P. M., which adds to the actual cost of furnishing the current. The meter is made to record on one or the other dial by self-winding clockwork.

THE NEWLY OPENED LOCKPORT TROLLEY LINE is a great success. Manager Van Horn reports that he has made the trip of about 28 miles in an hour and thirteen minutes, half an hour of which has to be taken up inside of Buffalo. The road now owns the Kenmore line, having bought it this week on a mortgage foreclosure. Though the railroad commissioners refused to permit the road to take in the Kenmore line by forcing a way across the steam roads in the northern part of the city it will yet be used in some way as part of the entire system. The passenger cars of the Lockport line are the largest in use, and are equipped with 200-hp motors, the line to Niagara Falls owned by the same company having only 120-hp motors. A speed of 50 miles an hour has been developed between Tonawanda and Lockport. The freight motors, which are similar to those used by the Baltimore & Ohio road, are four to a car of 100 horse-power each.

### MILWAUKEE NOTES.

MILWAUKEE, Wis., August 26, 1898.

THE BADGER STATE LONG-DISTANCE TELEPHONE COMPANY of Baraboo has extended its line to Kilbourn, a distance of 14 miles.

A FRANCHISE was granted by the Council of Durand, Mich., to the Long Lake, Durand & Corunna Street Railway Company. The power house and car stables will be located at Durand. The road will run from Corunna to Detroit.

### ST. LOUIS NOTES.

ST. LOUIS, Mo., August 25, 1898.

SHOOTING HOLES IN CABLES.—Vandals have been shooting holes in the lead casings of the Kinlock Telephone Company's overhead wires. The Bell Telephone Company has also suffered. Efforts are being made by both companies to locate the miscreants.

THE STRIKE OF THE LINEMEN of the Missouri-Edison Electric Light Company is still on, but many of the striking linemen are weakening. About forty went to work last Monday, and more will very likely soon follow. The strikers, however, say they will not give in.

CITY LINES TO GO UNDER GROUND AT ONCE.—The lighting committee of the board of public improvements has decided to go ahead with the work of burying the wires despite the fact that the specific ordinance providing for their burial has not been passed, though the money has been appropriated to pay for the work.

THE PRESIDENT OF THE LINEMEN visited the managers early this week and was received courteously by each one. In each instance he was informed that no men were needed, and that work was slack. The managers seemed willing to talk the matter over, and a conference may be held. The linemen say the firms are being crowded with orders, and that they attempt to hire all men who apply for work.

### PACIFIC COAST NOTES.

SAN FRANCISCO, Cal., August 21, 1898.

THE SUNSET TELEPHONE & TELEGRAPH COMPANY recently received 685,000 pounds of copper wire, the greater part of which will be required in placing the telephone circuits in Sacramento, Cal., under ground. The California-Oregon gap is being closed up rapidly, and probably in less than three months the States of California, Oregon, Washington and Idaho will be joined by one long-distance system. Conversations can then be carried on between San Diego, Cal., and Boise City, Idaho, a distance of 1950 miles.

THE SAN FRANCISCO GAS & ELECTRIC COMPANY was finally awarded the city street lighting contract for the term of two years from August 1, 1898. The bids, as advertised, called for both gas and electric services from each bidder. The above-named company was the only one that could comply with such terms. There will be a large increase in the number of arc lights for street illumination and a corresponding decrease in the number of gas lights. The San Francisco Gas & Electric Company, in anticipation of

the increased demand for electric lighting, has installed four additional 100-kw direct-current generators on its three-wire system, and six additional 150-light arc machines at the arc lighting station. Additional overhead wires are being strung for the use of the street service.

THE SNOQUALMIE FALLS POWER COMPANY, which recently let contracts for four 1500-kw generators to the Westinghouse Electric & Manufacturing Company, intends to keep the details of the "Snoqualmie Impeller Type" wheels, which are being constructed, a secret until they are put into operation. They are said to be neither turbine nor impact wheels, and their aggregate capacity is to be 12,000 horse-power. The head of water is 270 feet. Included among the supplies and apparatus, for which contracts amounting to $350,000 have been let, are 22,000 Imperial porcelain insulators for 25,000-volt circuit, 5000 barrels of cement and 150,000 pounds of aluminum-copper wire. There will be 1½ per cent. of pure Lake copper in the 500 miles of circuits, which will supply Seattle, Tacoma and way points with electric power. It is reported that the Knight Water Wheel Works, of Sutter Creek, Cal., are to build ten large wheels for a Western electric installation.

## CANADIAN NOTES.

OTTAWA, Ont., August 26, 1898.

THE WEST KOOTENAY POWER & LIGHT COMPANY is now delivering 1000 horse-power in Rossland, B. C., from its generators at Bonnington Falls, 30 miles away.

THE PROPOSED ELECTRIC RAILWAY between the towns of Lanark and Perth, Ont., is being revived. The subscribed capital is now said to be sufficient to build the road, and the company undertakes to complete it by April 1 next.

THE TOWN OF DUNDAS, Ont., will give a franchise for fifteen years to an electric lighting company, of which George H. Harper is managing director, the town to have 150 incandescent lamps and four arc lights. The lights will cost the town $1100 per annum.

AN ELECTRIC RAILWAY FROM MONTREAL TO ST. BRUNO will be built by a number of Montreal gentlemen, who have purchased a mountain at St. Bruno, in the Chambly district, about 10 miles from Montreal, and propose spending a large sum in improvements.

THE ELECTRIC RAILWAY SYSTEM will not be extended from Quebec to Montmorency this year, but everything will be got in readiness during the winter to change the motive power of the entire railway from Quebec to Cap Tourment from steam to electricity next spring.

ANOTHER HEAVY TRANSACTION IN ELECTRIC PROPERTY is on foot in the Province of Quebec. Following the absorption of the Quebec District Railway Company by the Quebec, Montmorency & Charlevoix Company, the latter is about to acquire the property of the Montmorency Power Company, which furnishes the city with electric light and the street railway cars with their motive power. It is understood that the purchase price is $1,250,000. A meeting of the Quebec, Montmorency & Charlevoix Electric Railway Company will be held on September 13 to ratify the purchase. The shareholders of the power company will receive a handsome premium on their stock, which will be 25 per cent. of its value in cash, while they will also raise in the stock of the Quebec, Montmorency & Charlevoix Railway an amount equal to their stock in the Montmorency Power Company.

ELECTRIC TRANSMISSION FROM THE WELLAND CANAL TO TORONTO.—Mr. Henry Symons, Q. C., has recently returned from England, where he had estimates prepared for the construction of the proposed works of the Welland Power & Supply Canal Company. This project involves the construction of a canal from the Welland River to the brow of the mountain at Thorold, Ont., a distance of 8 miles; the construction at Thorold of a power house, and from Thorold to Lake Ontario a raceway by which to carry water into the lake. In addition to these different works estimates were obtained for the construction of a transmission line from Thorold to Toronto by way of Burlington Beach. The estimates obtained by Mr. Symons were prepared by Dr. Hopkinson, one of the leading electricians of Great Britain; Sir Douglas Fox, Edmund Wragge, late of Toronto, and W. C. Unwin. The estimate for the machinery to generate 100,000 horse-power is £125,000; for transmission line to Toronto at a voltage of 10,000 and delivery of 50,000 horse-power, £801,600; for excavation and other work connected with the undertaking, £1,525,062. The total estimate therefore amounts to £2,452,162, or roughly speaking, $12,000,000. If the amount to be delivered in Toronto is reduced to 20,000 horse-power the project would cost $1,000,000 less. S. Pearson & Son, contractors, state that if the contract could be secured from the cities of Toronto and Hamilton for a considerable quantity of power, for a definite term, there would be little difficulty in raising money for the project by bonds and shares in Great Britain.

## ENGLISH NOTES.

(From Our Own Correspondent.)

LONDON, August 17, 1898.

THREATENED TRANSFORMER PATENT LITIGATION.—Mr. Martin D. Rucker, who has made a name for himself in the flotation of cycle companies, has brought up the famous Zipernowsky-Déri patent, which has now only one year to run, and he threatens to proceed against all the alternating current supply stations for infringement, and to enforce the payment of certain royalties to him. Proceedings are already being commenced against the London Electric Supply Corporation, and the municipalities which have alternating plants have decided to combine with this company and some of the other supply companies to resist the claim, and if necessary to fight the matter on appeal to the House of Lords. In electrical circles it seems to be the general opinion that Mr. Rucker will have very little success in his new speculation.

THREE-PHASE EXTENSIONS AT MANCHESTER.—A system of three-phase high pressure generation and transmission, combined with low pressure distribution, is to be used in Manchester on some extensions which are being made. The system at Manchester is a continuous current five-wire system at 400 volts between the outers, and in parts a three-wire system at 400 volts between the outers. Continuous current from the central station bus-bars will be transformed by means of rotary and stationary transformers into a 5000-volt three-phase current, and then will be conveyed to sub-stations in the new district in question by means of three-core cables. There it will be converted back into low pressure continuous current for distribution on the three-wire system at 400 volts between the outers. The initial plant will only be of 600-kw capacity.

CONDUIT EXPLOSIONS.—Two serious conduit explosions occurred last week, one in Regent's Park, London, and the other on the circuits of the Oldham Corporation electric lighting undertaking. Both were due to the leakage of gas into the ducts from broken gas pipes. In Regent's Park, which is on the circuit of the St. Pancras Vestry's electric light station, three heavy manhole covers were blown out, and a length of 200 yards of bare strip conduit was seriously damaged. In this case it is especially remarkable that such a serious explosion should have occurred, as there are no less than four ventilating shafts in the 200 yards of conduit, and the matter can only be explained by the gas having accumulated with great rapidity just previous to the explosion. The faulty gas pipe crossed the conduit at a point 70 yards distant from where the explosion occurred, and at this point there were workmen engaged in searching for the leakage. It is possible that it was here that the ignition took place, in which case the flame must either have run along the conduit or else along the surface of the road. It will be remembered that a few years ago similar explosions occurred on the St. Pancras mains, the cause of these having been traced to insufficient ventilation of the ducts and the formation of sodium on the surface of the insulators, which caused the ignition of the accumulated gas. Now, however, the mains are laid on a much better principle, highly glazed three-lipped insulators are used, and no traces of sodium were found after the explosion. At Oldham 50 yards of pavement were torn up, and here the ignition was caused by the turning off of the switch in the base of an arc lamp-post. The only damage to person was at Oldham, where a woman was injured on the knee.

THE TELEPHONE QUESTION.—The committee of the House of Commons which was appointed to inquire into the telephone question with a view to recommending whether municipalities should be granted licenses on a similar footing to that granted to the National Telephone Company has issued its report. Although it appears there was a sort of understanding between the National Telephone Company and the Post Office that no competition with the former should be instituted, except in such districts where the telephone service was proved to be inefficient, the committee reports that there is no legal reason why new licenses should not be conceded for a term equal to that originally conceded to the company. It recommends that licenses should be given under certain conditions to municipalities, but that these should lapse to the Post-Office in 1911, at the time when the National Telephone Company's license lapses. Among the conditions to be imposed are that all new systems are to have double wires and to be erected in accordance with the regulations of the Post Office. The committee recommends that the Post Office should insist upon complete uniformity of systems so far as the differing conditions of the different localities permit, and that both a maximum and minimum rate should be imposed, so that on the one hand the municipalities should have no inducement to carry on the service at a profit, and on the other hand the Post Office may be protected against a reduction of rates to a point that would involve an unremunerative service after 1911. A royalty of 10 per cent. of the gross profits is to be paid to the Post Office; the same royalty that the National Telephone Company now pays. The Post Office itself will now probably start active competition in some districts, the main object, it appears, being to lessen the value of the National Telephone Company's business by the time its license expires. The disadvantages of a competing telephone service, which have been felt in the States for some time past, will now be experienced in this country, it seems for the next twelve years, until the Post Office has acquired the whole system of telephones, as it should have done nearly twenty years ago.

# General News.

## NEW INCORPORATIONS.

THE KEYSTONE ELECTRIC CONSTRUCTION COMPANY, Tunkhannock, Pa., has been formed with a capital stock of $10,000.

THE MOUNTAIN HOME & WEST PLAINS TELEPHONE COMPANY, of Arkansas, has filed articles of incorporation in Missouri. The capital stock is $5000.

THE NEW ROCHELLE TELEPHONE COMPANY, New Rochelle, N. Y., has been organized for the purpose of dealing in telephones and telephone supplies.

THE MIDLAND TELEPHONE COMPANY, Adrian, Minn., has been formed with a capital stock of $50,000. Daniel Shell, of Worthington, is one of the incorporators.

THE WINCHESTER & LEXINGTON TELEPHONE COMPANY, Vine Grove, Ky., has been incorporated, with a capital stock of $1650, and the chief incorporator is T. C. Vanmeter.

THE PERRY TELEPHONE COMPANY, Duquoin, Ill., has been incorporated with a capital stock of $12,000. Among those interested are C. L. Downey, Robery O. Lehn and J. J. Dewey.

THE MORROW ELECTRIC LIGHT & POWER COMPANY was incorporated by the same persons and with the same amount of capital as the Loveland Power & Electric Light Company.

THE NORTH PARK TELEPHONE COMPANY, Walden, Col., has been incorporated by Montie Blevins, J. O. Mosman, George F. Scott, C. E. Mosman and M. C. Ward. The capital stock is $5000.

THE CITIZENS' TELEPHONE COMPANY, of Spartanburg, S. C., has been incorporated with a capital stock of $8000. The officers are: W. H. Clark, president; C. E. Fleming, manager and treasurer.

THE CENTRAL DAKOTA TELEPHONE COMPANY, Aberdeen, S. Dak., has been incorporated with a capital stock of $50,000. The incorporators are J. L. W. Zeitlow, E. G. Porter and W. H. Anderson.

THE DUNKIRK & REDNEY TRACTION COMPANY, Dunkirk, N. Y., has been incorporated with a capital stock of $75,000. Among those interested are Henry C. Bittingsley, C. A. Hanable and R. H. Hasbrouck.

THE SAGINAW & FRANKENMUTH RAILWAY COMPANY, Saginaw, Mich., has been incorporated with a capital stock of $50,000. The new company will build an electric road between Frankenmuth and Saginaw.

THE AMERICAN TELEGRAPH & TELEPHONE COMPANY, Little Rock, Ark., has been incorporated with a capital stock of $10,000. The incorporators are Clifford H. Strong, Gray Carroll and Thomas S. Busbee.

THE LOVELAND POWER & ELECTRIC LIGHT COMPANY has been incorporated at Columbus, Ohio, with a capital stock of $10,000. The incorporators are I. W. Newcomer, C. C. Stickelman, W. H. Stubbs, H. A. Coyne and R. B. Corwin.

THE PEOPLE'S TELEPHONE EXCHANGE has been organized at New Richmond, Wis. The officers for the first year are: President, Charles N. Gorham; vice-president and manager, A. J. Presson; secretary, William Hughes; treasurer, Dr. Epley.

THE PERRY ELECTRIC LIGHT, HEAT & POWER COMPANY, Newport, Pa., has been formed with a capital stock of $13,000. The incorporators are A. D. Van Dyke and S. S. Lelby, Marysville; J. K. Van Dyke and L. H. Smith, Philadelphia, and J. S. Lelby, Newport.

THE MARYLAND TELEPHONE & TELEGRAPH COMPANY, Baltimore, Md., has been incorporated with a capital stock of $30,000. It is said to be the intention of the company to purchase the interest of the Interstate Telephone Company, which now conducts the principal telephone system in Frederick.

THE KEESEVILLE ELECTRIC COMPANY, Chesterfield, Essex County, N. Y., has filed articles of incorporation with the Secretary of State. The directors are Orville S. Morse, Henry K. Prime and A. W. Boynton, Keeseville; George F. Morse, of Peru, and Henry E. Barnard, of Plattsburg. Capital stock, $30,000.

THE BROCKTON & WHITMAN STREET RAILWAY COMPANY, Brockton, Mass., has been incorporated for the purpose of connecting the two places named by an electric railway. The directors are Col. J. J. Whipple, Albert Davis, Whitman; Benjamin S. Atwood, C. Waldo Dyer, F. C. Kingman, Horace Kingman and William Jones.

THE ROCHESTER & SODUS BAY RAILWAY COMPANY, Rochester, N. Y., has been organized for the purpose of operating an electric railroad to Sodus Bay. The officers of the new company are: President, T. J. Nicholl; vice-presidents, first, J. C. Tone, second, Walter B. Duffy; treasurer, John H. Gregory; secretary, Charles Van Voorhis. Capital stock, $1,000,000.

## THE TELEGRAPH AND TELEPHONE.

INDIANAPOLIS, IND.—The New Telephone Company has certified to an increase of capital stock to $400,000.

PEORIA, ILL.—A new telephone line is to be put in between Peoria and Springfield, via Petersburg and Delavan.

LANCASTER, WIS.—The Wisconsin Telephone Company has been granted a franchise to establish an exchange in this place.

POLO, MO.—The Bell Telephone Company has purchased the Kingston and Hamilton telephone line, and will put it in first-class shape.

ROBY, TEX.—The Roby & Sweetwater telephone line has been purchased by Hughey, Green & McCrea, who will at once make a connection with Abilene and other outside points.

TIFFIN, OHIO.—The Ohio Telephone Company has begun the work of stringing its line to Bettsville to connect with the Home Telephone Company of this city. Connection will be made with Fort Seneca.

WATKINS, N. Y.—A new metallic circuit telephone line between this place and Gibsons has just been completed. It is intended to extend the line to Wayne, Tyrone and other points in Yates and Schuyler counties.

MANKATO, MINN.—The Mankato Citizens Telephone Company has awarded the contract for installing a 200-'phone plant in this city to H. M. Kellogg for about $7000. The contract is to be completed within ninety days.

SPRINGFIELD, TENN.—The Cumberland Telephone & Telegraph Company has just completed a new line to Baggettsville and White House. The completion of this line gives Springfield telephonic communication with every point in the county.

LUBEC, ME.—An exchange has been recently opened at this place and telephone connection established with North Lubec and Whiting. The lines through Dennysville, Pembroke, West Pembroke, to Eastport and Calais will soon be ready for business.

SPOKANE, WASH.—The Inland Telephone & Telegraph Company has recently completed its new line to Baker City, Ore., and the line is now in operation. The company has also recently put in exchanges at Farmington, Cheney and Wilbur, and has agreed to put in exchanges at Rosalia, Pomeroy and Northport.

## ELECTRIC LIGHT AND POWER.

ATLANTIC CITY, N. J.—Messrs. John H. Rothermel & Co., of Reading, Pa., have been granted a franchise to construct and operate an electric light plant in this city.

HELENA, MONT.—The City Council has passed an ordinance granting to the Helena Water & Electric Power Company a franchise allowing it to deliver electric power in the city.

KOKOMO, IND.—Three applications for receivership have been filed against the Citizens Electric Light & Power Co., with claims aggregating $12,800. The company is capitalized at $40,000.

WHEATON, ILL.—The city of Wheaton is considering the purchase of the local electric light plant. The city now pays $3000 per year for electric light, and has been offered the plant for $20,000.

NEWPORT NEWS, VA.—The City Council has granted to the Newport News & Old Point Railway & Electric Company a franchise to operate an electric light plant here for a period of fifty years.

COHOES, N. Y.—By the terms of the new contract for lighting the streets of Cohoes, which will go into effect on September 1, the rate will be $33 per light less per year, making a saving of $4,752 per year.

HACKENSACK, N. J.—The Hackensack Gas & Electric Company has received a franchise to wire the borough of Delford, the Delford Electric Light Company having surrendered the franchise recently granted to it.

CHICAGO, ILL.—The Commonwealth Electric Company has purchased from the Calumet Gas Company the latter's electric plant at Garfield Boulevard and Wallace Street, and the part of the plant at Ninety-sixth Street and Erie Avenue, South Chicago, for $500,000.

SEDALIA, MO.—The property of the Sedalia Water & Light Company was sold to a syndicate composed of H. C. Warren, of New Haven, Conn.; E. Burr, Jr., and H. M. Knapp, of Bridgeport, Conn, and four local capitalists. The consideration is said to have been $400,000.

ST. LOUIS, MICH.—Sealed proposals for the construction of a dam and power house and the installation of water power and steam power apparatus and an electric light plant will be received by the board of public works of St. Louis, Mich., up to 8:30 P. M. September 9, and then publicly opened and read. Mr. E. Z. Burns is the consulting engineer.

WESTERVILLE, OHIO.—The Westerville Electric Company has been incorporated and has secured the contract with the town for ten arc lights and fifty 32-cp incandescent lights for five years. Also about 500 private lights will be put in to start with. The 220-volt system will be put in with a 40-kw dynamo. Mr. E. S. Aldrich, No. 13 Wesley Block, Columbus, Ohio, will be electrical engineer in charge, and wishes prices on a 40-kw generator, ten 220-volt lamps, 6000 pounds waterproof wire and all supplies necessary to complete the plant. Lights are to be burning before November 1, 1898.

## THE ELECTRIC RAILWAY.

WALTON, N. Y.—The right of way for an electric road from Margaretville to Andes has been secured.

CORUNNA, MICH.—The Long Lake, Durand & Corunna Electric Street Railway Company has been granted a franchise to operate an electric road in Durand.

CLEVELAND, OHIO.—The County Commissioners have granted a franchise for the extension of the Euclid Avenue line through Euclid Heights Boulevard.

SPRINGFIELD, OHIO.—Work has been commenced on the Springfield and Dayton electric line, and it is expected that the road can be completed within ninety days.

BROCKTON, MASS.—It is proposed to connect Brockton and Whitman by an electric railway, the Brockton & Whitman Street Railway Company having been formed for this purpose.

CATSKILL, N. Y.—The Catskill Electric Railway Company has at last been granted permission to increase its capital stock from $30,000 to $400,000. This increased stock was asked for in order to enable the company to construct an electric road from Catskill to Cairo.

ELIZABETH, N. J.—The Union County Chosen Board of Freeholders, in consideration of $250,000, has granted a franchise to John Kean, to build an electric road from this city to Plainfield, a distance of 12 miles. The term of the franchise is seventy-five years.

BLOOMINGTON, ILL.—The Bloomington & Normal Railway Company, as successor to the Bloomington City Railway Company, has negotiated a mortgage with the Illinois Trust & Savings Bank of Chicago, as trustee, to secure an issue of $250,000 first mortgage 5 per cent. bonds.

SAGINAW, MICH.—Judge Snow has filed an order authorizing the sale of the Consolidated Street Railway property to satisfy a claim held by the Boston Safe Deposit & Trust Company, in trust, amounting to $253,719, exclusive of all prior claim on account of receivers' certificates, amounting to $30,000.

HUDSON, N. Y.—The Hudson street railway has been purchased by Charles Cooper, of Brooklyn, who represents the Brooklyn Traction Company. He also secured a controlling interest in the Kinderhook & Hudson Steam railroad, running between Hudson and Niverville, a distance of 18 miles. It is said that the latter will be converted into an electric line and run in connection with the Hudson city road, which will be extended to Philmont. The consideration for the property and franchise is placed at $500,000.

BROOKLYN, N. Y.—Negotiations are in progress between the Brooklyn Elevated Railroad Company and the Brooklyn Heights Railroad Company, looking to a traffic arrangement by which the former will be able to operate its new trolley routes to Bensonhurst and Bath Beach. The plan is to have the Heights road continue its Avenue C routes across the Ocean Parkway and down Sixteenth Streeth to the Eighty-sixth Street line, and thence through to Bath Beach and Bensonhurst, the elevated road making a connection by means of an inclined plant at Thirty-sixth Street.

BROOKLYN, N. Y.—The work of stringing the electric wires on the old elevated railroad structure at Coney Island is rapidly nearing completion, and it is expected that everything will be in readiness by September 1. The Brook-

lyn Heights Railroad Company secured control of the property formerly belonging to the Sea View Elevated Railroad Company last July, and immediately commenced work on the structure in order to make it secure for the heavy trolley cars. The Sea View Company went out of business a few years ago, and until last June nothing in the way of any business had been done on the line.

NEW YORK, N. Y.—Judge Cohen, of the Supreme Court, has appointed a receiver for the New Paltz & Walkill Valley Railroad Company, on the application of the directors for the voluntary dissolution of the corporation. The bond of the receiver was fixed at $50,000, and the order to show cause was set down for December 1 next. The road extends from the tracks of the West Shore Railroad at Highland, N. Y., to the village of New Paltz. The company was incorporated January 16, 1897, with a capital stock of $150,000. The total liabilities are said to be $185,736, and the nominal assets $154,196.

## LEGAL NOTE.

THE CONDICT CONTROLLER PATENT.—Judge Lacombe, of the United States Circuit Court for the Southern District of New York, on August 25 issued preliminary injunctions on the Condict patent controlled by the General Electric Company against the Nassau Electric Railroad of Brooklyn, enjoining the further use of the electric car controllers, which were made by the Steel Motor Company, and against the Walker Company, enjoining its manufacture of the several types of series parallel car controllers made by it. The operation of this injunction is suspended until the next session of the Court of Appeals to give the defendants an opportunity for appeal. This is the same patent recently sustained at final hearing by Judge Townsend in a suit against a user of Walker controllers.

## PERSONAL NOTE.

MR. F. E. DRAKE, of the Walker Company, has been selected as electrical adviser to Commissioner General Ferdinand Peck of the United States to the Paris exposition of 1900. Mr. Drake sails for France with the commissioner general and party on the steamer La Touraine from New York on September 3. He expects to return to this country about the middle of October, and will then resume his duties with the Walker Company.

# Trade and Industrial Notes.

THE AMERICAN CIRCULAR LOOM COMPANY has moved its New York office and storeroom to the Hamilton Building, corner Thames and Greenwich Streets, where the New York agent, Mr. H. B. Kirkland, will carry a full stock of electroduct.

THE ILLINOIS ELECTRIC COMPANY states that it is now in a position to furnish an incandescent arc lamp for direct or alternating current. The company guarantees these lamps in every respect, and asks the trade to secure its prices before placing orders elsewhere.

MR. V. C. GILPIN, 120 Liberty Street, New York, metropolitan representative of the Cutter Electrical & Manufacturing Company, of Philadelphia, states that the C. S. and I-T-E specialties, manufactured by his company, continue to grow in popular favor with the electrical trade.

MESSRS. CHARLES WHITE AND ARTHUR R. MIDDLETON have purchased from Mr. Louis S. Houghton his interest in the business carried on under the style of the White & Middleton Gas Engine Company, of Baltimore, Md., and will continue the manufacture of gas engines under the same firm name.

THE BEACON LAMP COMPANY, New Brunswick, N. J., guarantees that its 3.5-watt lamps will maintain their average initial candle power for 300 hours or more. A free sample lamp may be obtained by any station manager by addressing the company. Such samples can be tested scientifically, or, in the absence of photometric instruments, a dozen Beacon lamps may be placed in service, and run 300 hours; at the end of this time, half of the lamps may be taken off and replaced by new lamps of Beacon or other makes. It will then be found, the company states, that the remaining lamps which have been in service will give as much light as, if not more than, the new lamps.

WHILE IRON OR STEEL ARMORED CONDUIT is being used to the exclusion of almost everything else in new conduit work, there is nevertheless some work where iron armored conduit can not be used. The most satisfactory substitute under such circumstances is Canvasite flexible conduit. This is particularly useful in wiring or rewiring old buildings, and in difficult and out-of-the-way places in new buildings. The Electric Appliance Company, of Chicago, is carrying Canvasite flexible conduit in all sizes, from one-fourth inch to 1¼ inches, and finds that it has a ready sale for the above mentioned uses.

THE C & C BRUSH HOLDER.—In an article in THE ELECTRICAL WORLD of July 23, 1898, entitled, "Some Modern Brush Holders," the reaction brush holders as designed by Mr. R. N. Baylis and various modifications of the same were described. The form of this holder used by the C & C Electric Company was one of these modifications, and the C & C Company, fearing that it might be understood that this was used under license from Mr. Baylis, wishes it stated that it is used by proprietary right, Mr. Baylis being at the time he developed this brush holder the chief engineer of the C & C Company, and materially assisted by that company in making experiments necessary to the perfection of this holder. On this account also the C & C Company was the first to adopt this improvement.

AT THE RECENT MEETING of the National Association of Fire and Police Telegraph Superintendents and Municipal Electricians a committee consisting of William Brophy, inspector of wires, Boston, Mass.; M. W. Mead, superintendent bureau of electricity, Pittsburg, Pa.; George F. MacDonald, superintendent fire alarm, Ottawa, Canada; F. C. Mason, superintendent police telegraph, Brooklyn, N. Y., and W. N. Thompson, superintendent fire telegraph, Richmond, Va., made the following creditable report on the exhibit of the Montauk multiphase cable: "We find properly located and connected up one fire-alarm box, arranged so as to be operated from an auxiliary sub-station; also the proper arrangements and connections for automatically sending in an alarm of fire by means of multiphase cable, a fusible wire being burned through or cross connected by contact with a slight blaze or fire such as a match might cause. On the application of a very slight fire from a match the multiphase cable was cross connected, thus throwing on an additional current of electricity, the composite wire was melted, thus opening properly another line, relieving a light current, which had previously been in operation. By these simple means, the main box was pulled, the alarm struck on a local gong attached to the circuit, a warning bell rung to indicate that the line was in operation, and the instantaneous sounding of its alarm showed that all claims as to the merits of the purpose and operations of the apparatus had been fulfilled. It is simple in action, and reliable as a fire alarm adjunct. The Montauk multiphase cable is practically a substitute for a thermostat, and this cable being run in out-of-the-way places, or in dangerous localities in buildings where fire is liable to occur, really makes a continuous thermostat, ready at all times for action in case of fire or dangerous heat at any point where the cable runs."

THE AMERICAN EXHIBITORS' AGENCY COMPANY for the Paris Exposition of 1900 has been incorporated under the laws of the State of New Jersey with a capital stock of $500,000, and has established general offices in the Commercial Cable Building, 20 and 22 Broad Street, New York, with a branch office in Paris. The purpose of the company's existence is indicated briefly in its title and explained more completely by the following statements of what the company proposes to do: 1st, To take the entire charge of exhibits from the moment they are ready for shipment until they are returned to their owners after the close of the exposition. 2d, To make all the preliminary arrangements, secure appropriate space, pay all charges for freight, insurance, customs, etc., and meet all other necessary expenses upon exhibits. 3d, To put exhibits in place with all necessary appliances, properly display them, care for them, bring their merits duly to the attention of visitors and juries of award, carefully repack and reship them at the close of the exposition, and give them in all respects the same personal care and attention they would receive from the exhibitors themselves. 4th, To act as agents for the sale of the various wares at the exposition, and to take orders for both the purchase and sale of all kinds of goods, wares and merchandise for its patrons. As this company will, in the execution of its functions, combine the representation of a large number of exhibitors, all outlays for salaries and expenses of separate special agents of individual exhibitors will be avoided. By its having always in its employ in Paris a regularly salaried corps of skilled artisans, mechanics and laborers capable of installing, arranging, and caring for all kinds of exhibits in a satisfactory and expeditious manner, the cost of special labor to each exhibitor will, through its medium, be saved, and the scarcity, unskillfulness, or exorbitant demands of labor guarded against; and by means of the combination of shipments and general charters ocean freight rates and other transportation charges will be greatly reduced, as will also insurance premiums and various incidental expenses. In addition to these considerations of economy, it may be stated that, through the employment of this company, exhibitors will be relieved of many costly and vexatious delays and annoyances resulting from unfamiliarity with the French language had French methods of doing business. Competition for the company's service will be a fixed charge, the amount of which will be duly contracted for with the exhibitor in advance.

## Directory of Scientific Societies, Associations, Etc., and Meetings of the Same.

FRANKLIN INSTITUTE (Electrical Section), Philadelphia, Pa.—Secretary, William H. Wahl.

THE NEW YORK ELECTRICAL SOCIETY.—President, Gano S. Dunn; secretary, George H. Guy, New York.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—F. W. Putnam, secretary, Salem, Mass.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA, Pittsburg, Pa.—Meetings, third Tuesday of each month.

CANADIAN ELECTRICAL ASSOCIATION.—President, William H. Browne, Montreal; secretary, C. H. Mortimer, Toronto, Ont.

CHICAGO ELECTRICAL ASSOCIATION.—Meetings, first and third Fridays of each month, from October 1 to June 1; J. R. Cravath, secretary.

NORTHWESTERN ELECTRICAL ASSOCIATION.—President, F. A. Copeland, La Crosse, Wis.; secretary, Thomas R. Mercein, Milwaukee, Wis.

MASSACHUSETTS CHARITABLE MECHANIC ASSOCIATION, Boston, Mass.—Exhibition of Motor Carriages, October 10 to December 3, 1898.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK.—President, G. Tracy Rogers, Binghamton, N. Y. Next meeting, Manhattan Beach, September 13 and 14, 1898.

NATIONAL ELECTRIC LIGHT ASSOCIATION.—President, A. M. Young, Waterbury, Conn; secretary, George F. Porter, New York. Next meeting, New York, May or June, 1899.

AMERICAN STREET RAILWAY ASSOCIATION.—President, A. E. Lang, Toledo, Ohio; secretary, T. C. Penington, Chicago, Ill. Next meeting, Boston, Mass., September 6, 7, 8 and 9, 1898.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS.—President, W. W. Ryder, Chicago; secretary, P. W. Drew, Milwaukee, Wis. Next meeting, Wilmington, N. C., June 19, 1899.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, New York.—President, Dr. A. E. Kennelly; secretary, Ralph W. Pope. Meeting, third Wednesday of each month, from September 1 to June 1.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES.—President, Samuel Insull, Chicago; secretary, Wilson S. Howell, Harrison, N. J. Next meeting, Sault Ste. Marie, Mich., September 12 and 13, 1898.

THE PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION. President, W. F. Pierce; secretary, George P. Low, 427 Tenth Avenue, San Francisco, Cal.

THE OHIO ELECTRIC LIGHT ASSOCIATION.—President, Emil C. Schmidt, Sandusky; secretary and treasurer, Samuel Scovil, Cleveland. Next meeting place, Cleveland, 1899.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION.—Dr. C. R. Dickson, Toronto, Can., president; Dr. John Gerin, Auburn, N. Y., secretary. Next meeting, Buffalo, N. Y., September 13, 14 and 15, 1898.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION.—President, Robert E. Wright, Allentown; secretary, S. P. Light, Lebanon. Next meeting, Scranton, Pa., September 7-8, 1898.

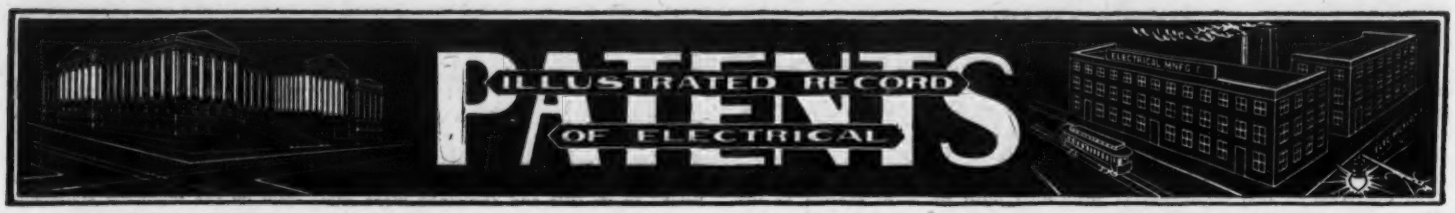
ASSOCIATION OF FIRE AND POLICE TELEGRAPH SUPERINTENDENTS AND MUNICIPAL ELECTRICIANS.—President, J. W. Aydon, Wilmington, Del.; secretary, H. T. Blackwell, Jr., New York. Next meeting, Wilmington, Del.

THE SOUTHWESTERN GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION.—President, Carl F. Drake, Austin, Tex; secretary, E. L. Wells, Jr., Marshall, Tex. Next meeting, Austin, Tex., April 19, 1899.

INDEPENDENT TELEPHONE ASSOCIATION OF THE UNITED STATES.—President, Judge James M. Thomas, Chillicothe, Ohio; secretary, W. J. Vesey, Fort Wayne, Ind. Next meeting, June, 1899. Place to be named hereafter.

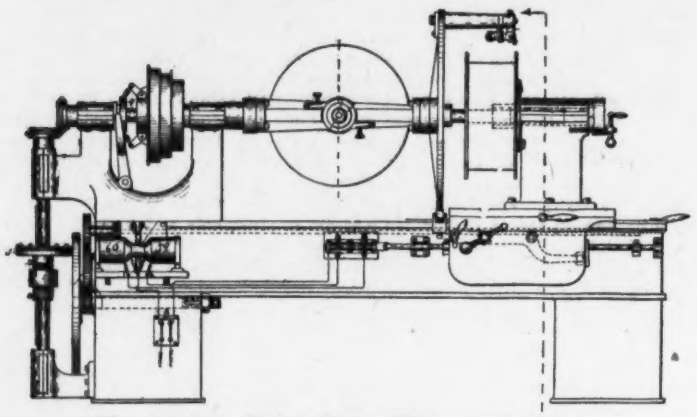
## Business Notice.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 9-15 Murray Street, New York City.




UNITED STATES PATENTS ISSUED AUGUST 23, 1898.
[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

609,421. DEVICE FOR ATTACHING OR DETACHING ELECTRIC LAMP BULBS; C. G. Edwards, of Albert Lea, Minn. App. filed Jan. 24, 1898. A device for attaching and detaching the bulbs of electric lamps, consisting of a rotatable handle and grasp or holder adapted for engagement with the bulb, and connecting with the handle, and an adjustable and removable spring guard extending out from said handle.



No. 609,620.—Field Spool Winding Machine.

609,614. ELECTRICAL APPLIANCE FOR ASSISTING ANATOMICAL ORGANS; J. Doty, of Syracuse, N. Y. App. filed March 22, 1898. An appliance for assisting the male generative organ in the natural performance of its functions, consisting of a wholly elastic loop and means to stretch it longitudinally to produce downward and rearward pressure upon the corpus cavernosum and congestion of its blood vessels.

609,620. FIELD SPOOL WINDING MACHINE; William Leiste, of Norwood, Ohio. App. filed Aug. 14, 1897. In a field-spool winder, the combination of a support, a frame rotatively mounted thereon, a reciprocally moving carriage on the frame, reversible mechanism for moving the carriage, a manually operated mechanism for moving the carriage, and means for simultaneously throwing one of said carriage moving mechanisms out of and the other mechanism into operation.

609,639. ELECTRO-MEDICAL APPARATUS; R. H. Wappler, of New York, N. Y. App. filed Nov. 2, 1897. The combination with the rheostat coil, of two sliders, a shaft, cranks and connections for moving the sliders in opposite directions, a hand upon the crank shaft and a dial for indicating the action of the rheostat in the electric circuit.

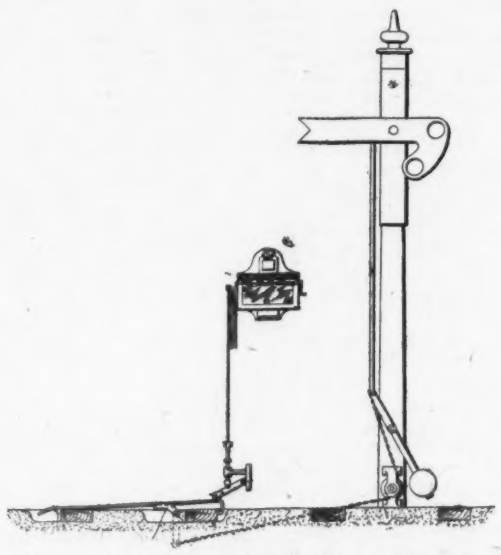
609,640. BURGLAR ALARM; D. L. Wartzenlift, of Kutztown, Pa. App. filed Nov. 16, 1897. A burglar alarm, comprising an electric circuit, the wires of which are extended across a window or the like, an alarm in the circuit, and a circuit closer mounted to swing on one of the wires and adapted to close the circuit when swung out of its normal engagement with the window or the like.

609,702. MANUFACTURE OF FLUIDS FOR IMPREGNATING FIBRES FOR INCANDESCENT LIGHTING; G. B. Puchmuller, of Schoneberg, Germany. App. filed March 21, 1898. A fluid composed of a solution of oxids of strontium, zirconium, barium and aluminum.

609,732. APPARATUS FOR SIGNALING ON LOCOMOTIVES; F. A. Cheetham, of Rastrick, and R. Bostock, of Brighouse, England. App. filed Jan. 18, 1898. In an apparatus for signaling in locomotives, the combination with a weighted faller and a semaphore connected thereto, carried by the locomotive; of means for supporting said faller; a shaft and connections for releasing said faller, a pivoted lever carried by the locomotive, connections between said lever and said shaft for operating the latter; a plate situated between the tracks, and means for operating same to bring it into contact with the pivoted lever during the travel of the locomotive, so that through the said shaft the faller is released and the semaphore operated; and means for raising the faller.

609,745. DIAPHRAGM FOR ELECTROLYTIC PURPOSES; William G. Luxton, of Liverpool, England. App. filed April 9, 1898. A diaphragm made of a composition of cement, sand and a porous material mixed with water and allowed to dry, or set, said diaphragm having pores through the substance of the porous material and interstices between the cement and the other constituent particles.

No. 609,421.—Device for Attaching or Detaching Electric Lamp Bulbs.



No. 609,732.—Apparatus for Signaling on Locomotives.